MOTOROLA

DYNA T·A·C™

Cellular Portable Telephone

Model F09DTD8824AN

Instruction Manual

68P81046E60-O

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DYNA T•A•C CELLULAR PORTABLE TELEPHONE

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FOREWORD

1. SCOPE OF MANUAL

This manual is intended for use by experienced technicians familiar with similar types of equipment. It contains all service information required for the equipment described and is current as of the printing date. Changes which occur after the printing date are incorporated by Instruction Manual Revisions (SMR). These SMR's are added to the manuals as the engineering changes are incorporated into the equipment.

2. MODEL AND KIT IDENTIFICATION

Motorola equipments are specifically identified by an overall model number on the nameplate. In most cases, assemblies and kits which make up the equipment also have kit model numbers stamped on them. When a production or engineering change is incorporated, the applicable schematic diagrams are updated.

3. SERVICE

Motorola's National Service Organization offers one of the finest nation-wide installation and maintenance programs available to communication equipment users. This organization includes approximately 900 authorized Motorola Service Stations (MSS) located throughout the United States, each manned by one or more trained, FCC licensed technicians.

These MSS's are independently owned and operated and were selected by Motorola to service its customers. Motorola maintenance is available on either a time and material basis or on a periodic fixed-fee type arrangement.

The administrative staff of this organization consists of national, area and district service managers and district representatives, all of whom are Motorola employees with the objective to improve the service to our customers.

Should you wish to purchase a service contract for your Motorola equipment, contact your Motorola Service Representative, or write to:

National Service Manager
Motorola Communications and Electronics, Inc.
1303 E. Algonquin Road
Schaumburg, Illinois 60196

REPLACEMENT PARTS ORDERING

ORDERING INFORMATION

Motorola maintains a number of parts offices strategically-located throughout the United States. These facilities are staffed to process parts orders, identify part numbers, and otherwise assist in the maintenance and repair of Motorola Communications Sector products.

Orders for all parts *except* crystals, active filters, channel elements, and "Vibrasender" ® and "Vibrasponder" ® resonant reeds should be sent to the nearest area parts center. Orders for instruction manuals should also be sent to the area parts center.

When ordering replacement parts or equipment information, the complete identification number should be included. This applies to all components, kits, and chassis. If the component part number is not known, the order should include the number of the chassis or kit of which it is a part, and sufficient description of the desired component to identify it.

Orders for crystals, channel elements, active filters, and reeds should be sent to the Component Product Sales & Service address listed below. Crystal and channel element orders should specify the crystal or channel element type number, crystal and carrier frequency, and the chassis model number in which the part is used.

Orders for active filters, *Vibrasender* and *Vibrasponder* resonant reeds should specify type number and frequency, should identify the owner/operator of the communications system in which these items are to be used; and should include any serial numbers stamped on the components being replaced.

COMPONENT PRODUCT SALES & SERVICE OFFICE

All Mail Orders
Motorola, Inc.
Component Product Sales & Service
P.O. Box 66191, O'Hare International Airport
Chicago, IL 60666

Correspondence
Motorola, Inc.
Component Product Sales & Service
2553 N. Edgington Street, Franklin Park, IL 60131
Tel: 312-451-1297, TWX: 910-227-0799, Telex: 433-0067

AREA PARTS OFFICES

Western Area Parts
1170 Chess Drive, Foster City, CA 94404
Tel: 415-349-8621, TWX: 910-375-3877

Pacific-Southwestern Area Parts
P.O. Box 85036, San Diego, CA 92138
Street Address:
9980 Carroll Canyon Road, San Diego, CA 92131
Tel(619-578-8030, TWX: 910-335-1516

Gulf States Area Parts
P.O. Box 73115, 1140 Cypress Station, Houston, TX 77090
Tel: 713-537-3636, TWX: 910-881-6392

Southwestern Area Parts
P.O. Box 34290, 3320 Belt Line Road, Dallas, TX 75234
Tel: 214-620-8511, TWX: 910-860-5505

Midwest Area Parts
1313 E. Algonquin Rd., Schaumburg, IL 60196
Tel: 312-576-7430, TWX: 910-693-0869

Southeastern Area Parts
P.O. Box 368, Decatur, GA 30031
Street Address:
5096 Panola Industrial Blvd., Decatur, GA 30032
Tel: 404-987-2232, TWX: 810-766-0876

Rocky Mountain Area Parts
20 Inverness Place East, Englewood, CO 80122
Tel: 303-790-2323, TWX: 910-935-0785

East Central Area Parts
12955 Snow Road, Parma, OH 44130
Tel(216-433-1560, TWX: 810-427-9424

Eastern Area Parts
85 Harristown Road, Glen Rock, NJ 07452
Tel: 201-447-4000, TWX: 710-988-5614

Mid-Atlantic Area Parts
7230 Parkway Drive, Hanover, MD 21076
Tel: 301-796-8763, TWX: 710-862-1941

National Accounts
Railroad, Airlines, and Telephone Sales
1313 E. Algonquin Rd., Schaumburg, IL 60196
Tel: 312-576-6512, TWX: 910-693-0869

All Canadian Orders
Motorola, Ltd., National Parts Department
3125 Steeles, Ave. E., Willowdale, Ontario M2H 2H6
Tel: 416-499-1441, TWX: 610-491-1032,
Telex: 06-526258

National Data Services

1171 West 17th Street, Tempe, AZ 85281
Tel: 602-994-6472, TWX: 910-951-1334

All Countries Except U.S. & Canada

Motorola, Inc., International Parts Department
1313 E. Algonquin Rd., Schaumburg, IL 60196. U.S.A.
Tel: 312-576-7241, TWX: 910-693-0869
Telex: 722443, Cable: MOTOL PARTS

PERFORMANCE SPECIFICATIONS

GENERAL

Frequency Range	825.030-844.980 MHz Tx 870.030-889.980 MHz Rx
Channel Spacing	30 kHz
Channels	666
Duplex Spacing	45 MHz
Frequency Stability	Reference oscillator maintains carrier within 2100 Hz of assigned center frequency (±2.5 ppm) from −30° to +60°C ambient (+20°C ref)
Operation	+6.0 to +9 V dc
Battery Drain at 7.5 V dc	Standby: Less than 40 mA (nominal) Transmit: Less than 850 mA (nominal Provides for ten 3-minute call transmit and 7.5 hour standby operation.
Dimensions	19.6 cm x 4.5 cm x 8.3 cm (7.7" x 1.8" x 3.3")
Size (Volume)	580 cubic cm (35.4 cubic in.)
Weight	Approximately 0.85 kg (30 oz.); includes battery and antenna
Temperature Range	−30°C to +60°C

TRANSMITTER

RF Power Output	0.6 Watts ±2 dB
Output Impedance	50 ohms (nominal)
Spurious and Harmonic Emissions	Complies with TITLE 47, PART 22 of the Code of Federal Regulations
Audio Distortion — Electrical	Less than 5% at 1000 Hz; ±8.0 kHz deviation
Audio Distortion — Microphone	Less than 5% @ 97 dB SPL input
Modulation	F3: ±12 kHz for 100% at 1000 Hz
FM Noise (C-MSG, weighted)	32 dB below ±8 kHz deviation at 1000 Hz
Audio Response — Electrical	6 dB/octave pre-emphasis
Audio Response Microphone and Preamp	Rising 3 dB/OCT, 300 Hz to 3000 Hz
Audio Sensitivity	±2.9 kHz deviation (nominal) @ 97 dB SPL input @ 1000 Hz

RECEIVER

Alternate Channel Selectivity (SINAD)	−65 dB at ±60 kHz
I-F Bandwidth	28 kHz min
12 dB SINAD (C-MSG weighted)	−116 dBm
Spurious & Image Rejection	Greater than 65 dB (Except 1/2 IF = 55 dB)
Spurious Conducted Emissions	Less than or equal to −60 dBm
IM (EIA 204C)	65 dB
RF Input Impedance	50 ohms (nominal)
Audio Distortion — Electrical	Less than 5% at 1000 Hz, ±8 kHz deviation
Audio Response	6 dB/octave de-emphasis
Audio Distortion — Earpiece	Less than 5% @ 99 dB SPL output
Audio Sensitivity	99 dB SPL (nominal) @ 1000 Hz, ±2.9 kHz deviation, max volume

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE
FCC DESIGNATION ABZ89FT5620

CAUTION

Do not jump start vehicle or use an automotive battery charger while the vehicle adapter option and the portable radiotelephone are connected to the vehicle electrical system as this may cause serious damage to the radio. Disconnect the radio by removing the cable kit fuses.

Model Chart
For
Model F09DTD8824AN
DYNA T•A•C Cellular Portable Radiotelephone

Model	Description
TAF6100A	Antenna
TLN2616A	Interconnect Board and Keyboard in Housings
TNN6000A	Battery; 7.5 V dc @ 800 mAh
TPN6157A	AC Trickle Charger
TRN5806A	Carrying Case

TLN2616A Interconnect Board and Keyboard Model Breakdown

Model	Description
THN6522A	Housing and Hardware
TLN2617A	Keyboard Display
includes:	includes:
THN6521A	Housing and Hardware
TRN5807A	Keyboard and Display Circuit Board
TLN2618A	Interconnect Board and Modules
includes:	includes:
TFN6048A or TFN6050A	45 MHz Filter Module
TLF6591A	Power Amplifier Module
TRN5834A	Isolator Module
TRN5836A	ID Module
TRN5838A	Flex-Strip
TRN5839A	Circuit Board
TRN5840A	Mixer Duplexer Module
TRN9123A	Reference Oscillator
TRN5808A	Logic Unit Module
TRN5823A	Receive Audio Module
TRN5824A	Transmit Audio Module
TRN5825A	DC Control Module
TRN5826A	Supervisory Audio Tones (SAT) Module
TRN5827A	Voltage Controlled Oscillator (VCO) Module
TRN5828A	Phase-Locked Loop (PLL) Module
TRN5829A	Receive Multiplier Module
TRN5830A	Phase Modulator Module
TRN5831A	I-F Module
TRN5832A	RF Amplifier Module
TRN5833A	Mixer Module
TRN5835A	Automatic Output Control (AOC) Module
TRN5837A	Antenna Duplexer Module
TRN5841A	Transmit Multiplier Module
TRN5937A	Interconnect Board Hardware Kit

DYNA T•A•C Cellular Portable Radiotelephone Options Chart

Model	Description
TLN2690A	AC Fast Charger
TLN2688A	Vehicle Adapter — Front Mount
TLN2689A	Vehicle Adapter — Rear Mount

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GENERAL SAFETY INFORMATION

The United States Department of Labor, through the provisions of the Occupational Safety and Health Act of 1970 (OSHA), has established an electromagnetic energy safety standard which applies to the use of this equipment. Proper use of this radio will result in exposure below the OSHA limit. The following precautions are recommended:

Portable Operation:

DO NOT hold the radio such that the antenna is very close to, or touching, exposed parts of the body, especially the face or eyes, while transmitting. The radio will perform best if it is held in the same manner as you would hold a telephone handset, and with the antenna angled up and over your shoulder. Speak directly into the microphone.

DO NOT allow children to play with any radio equipment containing a transmitter.

Mobile Operation (Vehicle Adapter):

DO NOT operate the transmitter of a mobile radio when someone outside the vehicle is within two feet (0.6 meter) of the antenna.

DO NOT operate the transmitter of any radio unless all cables and connectors are secure and any open connectors are properly terminated.

In addition,

DO NOT operate a portable/mobile transmitter near electrical blasting caps or in an explosive atmosphere unless it is a type especially qualified for such use. Portable and Mobile Radio Stations are under certain conditions, capable of interfering with blasting operations. When you are in the vicinity of construction work, look for and observe signs cautioning against radio transmission. If transmission is prohibited you ***must*** lock your portable/mobile telephone to prevent ***any*** transmission. *The radiotelephone equipment will automatically transmit to acknowledge a call if it is not locked.*

All equipment must be properly grounded according to Motorola installation instructions for safe operation.

All equipment should be serviced only by a qualified technician.

Portable/Mobile Telephone Use and Driving:

For your own safety, we strongly recommend that the *driver* should not use the portable telephone while the vehicle is in motion. Stop the car in a safe location before answering or placing a call.

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SAFETY INFORMATION FOR RADIOS INSTALLED IN VEHICLES POWERED BY LIQUEFIED PETROLEUM (LP) GAS

WARNING

It is mandatory that radio installations in vehicles fueled by liquefied petroleum gas conform to the following standard.

National Fire Protection Association standard NFPA 58 applies to radio installations in vehicles fueled by liquefied petroleum (LP) gas with the LP-gas container in the trunk or other sealed-off space within the interior of the vehicles. This standard requires that:

1. Any space containing radio equipment shall be isolated by a seal from the space in which the LP gas container and its fittings are located.
2. Remote (outside) filling connections shall be used.
3. Venting of the container space to the outside shall be provided.

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The batteries used in the operation of the portable telephone must be treated with the following precautions:

WARNING

The portable telephone battery pack may explode if disposed of in fire.

WARNING

The lithium battery used in the radio for memory retention must be treated with the following precaution:

- DO NOT short circuit the battery.
- DO NOT attempt to recharge the battery.
- DO NOT dispose of battery in fire or allow battery to get close to extreme heat.

Failure to observe these precautions could result in explosion of the battery and possible damage to equipment and/or personnel.

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DYNA T•A•C CELLULAR PORTABLE TELEPHONE GENERAL DESCRIPTION

1. CELLULAR SYSTEM OVERVIEW

NOTE

The following description is intended only as a preliminary general introduction to cellular systems. This description is greatly simplified and does not illustrate the full operating capabilities, techniques, or technology involved in cell systems.

1.1 OVERALL CONCEPT

1.1.1 The cellular systems are used to provide radiotelephone service in the frequency range 825-890 MHz. A cell system provides higher call handling capacity and system availability than would be possible with conventional radiotelephone systems (those which require total system area coverage on every operating channel) by dividing the system coverage area into several adjoining sub-areas or cells.

1.1.2 Each cell contains a base station (cell site) which provides transmitting and receiving facilities on a certain set of duplex frequency pairs (channels). Since each cell is a relatively small area, both the cell site and the radiotelephone that it supports can operate at lower power levels than would be used in conventional systems. Using this technique, radiation on a given channel is virtually contained in the cell operating on that channel and, to some extent, those cells directly adjacent to that cell.

1.1.3 Since the coverage area of a cell on a given channel is limited to a small area (relative to the total system coverage area), a channel may be reused in another cell outside the coverage area of the first. By this means, several subscribers may operate within the same geographic area, without interference with each other, on a single channel.

1.2 OPERATION

1.2.1 Refer to Figure 1. In the figure, the area bounded by bold lines represents the total coverage area of a hypothetical system. This area is divided into several cells, each containing a cell site (base station) operating on a given set of channels which interfaces radiotelephone subscribers to the telephone switching system. The radiotelephones themselves are capable of operation on any channel in the system, allowing them to operate in any cell. Due to the low power requirements for communications between radiotelephones in a particular cell and the cell site, operating channels may be repeated in cells which are outside the coverage area of each other.

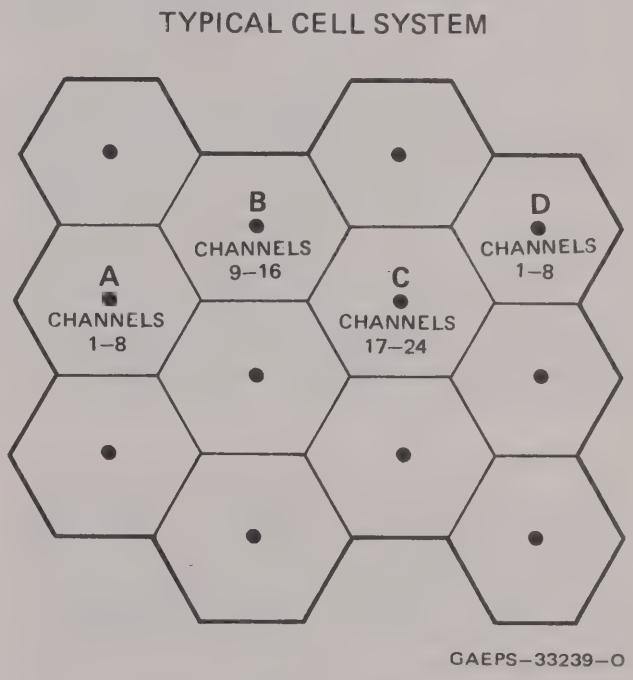

Figure 1. Hypothetical Cell System

1.2.2 For example, presume that cell A operates on channels arbitrarily numbered 1 through 8, cell B operates on channels 9 through 16, cell C operates on channels 17 through 24 and cell D operates on channels 1 through 8 (repeating the usage of those channels used by cell A). In this system, subscribers in cell A and subscribers in cell D could simultaneously operate on

channels 1 through 8 without interference, thus increasing the call-handling capability of the system without increasing the number of available channels.

1.2.3 In addition to signaling and voice communications, other telemetry such as channel selection information is passed between the cell site and radiotelephones within the cell. This telemetry enables the cell site to control the channel that an operating radiotelephone will use and also allow the radiotelephone to move from one cell to the next without an interruption in service.

1.2.4 When a radiotelephone is well within a cell, its signal strength to the cell site will be high. As the radiotelephone moves towards the edge of the cell, its signal strength decreases. Signal strength information provides an indication of the subscriber's distance. As the radiotelephone moves from cell to cell, it is informed to change channels to one of the operating channels in each new cell. This change is handled automatically by the radiotelephone and is completely transparent to the user.

1.2.5 For example, presume a radiotelephone initiates a call in cell A and then moves across the system area, through cells B and C to cell D. The call is initiated on channel 4. As the radiotelephone moves into cell B, it is instructed to change to channel 12 and then operates through the B cell site on that channel. A similar change is performed when the radiotelephone moves from cell B to cell C (e.g. from channel 12 to channel 22) and again when the radiotelephone moves from cell C to cell D (e.g. from channel 22 to channel 7). In this example, the radiotelephone has operated in four cells, through four cell sites, and on four channels without interruption in voice communications. Note that, as the radiotelephone leaves a cell, the channel on which the radiotelephone was operating is made available to another subscriber in that cell.

1.3 SERVICE AREA

1.3.1 The area within which calls can be placed and received is defined by the system operator. (Because this is a radio system, there is no exact boundary that can be drawn on a map.) If the portable is outside the radio service area, the **No Svc** (no service) message will appear and calls will be unable to be placed or received. If this happens during a conversation, the call will be lost.

1.3.2 There may also be small areas within a particular service area where communications may be lost. One area where it is very likely to lose the ability to place or receive calls would be in totally enclosed areas, such as underground parking garages, in buildings without windows and in elevators. This will be indicated either by the **No Svc** message illuminating, or by the sound of either a fast busy signal or a high-low siren signal when call placement is attempted.

1.3.3 General usage in buildings having reasonable glass area is usually guite good. However, it may be necessary to move closer to a window to ensure reliable operation.

2. CELLULAR PORTABLE TELEPHONE DESCRIPTION

2.1 GENERAL

The *DYNA T•A•C* Cellular Portable Radiotelephone (shown in Figure 2) is a microprocessor controlled, full duplex, synthesized FM radiotelephone for use in compatible 800 MHz cellular radiotelephone systems. When operated properly, the equipment will provide the user with land-linked telephone service through individual cell site base stations, all linked to a central control office.

Figure 2. DYNA T•A•C Cellular Portable Telephone With Trickle Charger

2.2 PHYSICAL PACKAGING

2.2.1 The transceiver circuitry is contained in a water resistant polycarbonate plastic housing measuring (including battery pack) 19.6(H) × 4.5(W) × 8.3(D) centimeters (7.7 × 1.8 × 3.3 inches) and weighs approximately 0.8 kg (30 oz.) with battery pack and antenna attached. Internally generated heat is conducted to

the internal aluminum frame where it is distributed and dispersed around the perimeter of the radio.

2.2.2 All of the active transceiver circuits are hybrid integrated circuit modules which plug into the interconnect board having all interconnecting printed wiring. This arrangement allows the modules to be easily removed and replaced without disturbing any circuitry. All terminations of interconnecting leads on major components and printed wiring boards have connectors at one end including those connections from the interconnect board to the keyboard, antenna and battery as well as from the keyboard to the speaker, alert transducer and microphone. The interconnect board and modules are protected by an internal metal frame and an external plastic housing.

2.2.3 Access to the internal circuits is obtained by removing the battery and antenna to expose the various fasteners which hold the radio together. ***There are no user serviceable components inside this radiotelephone. Service should be performed only by a qualified service technician.***

NOTE

It is possible to disassemble the radiotelephone using common tools, but it *cannot be reassembled without special equipment.*

2.2.4 The keypad, display and audio transducers provide the primary interface between the user and the *DYNA T•A•C* Portable Radiotelephone. The 21 keypad buttons are used to enter telephone numbers as well as control commands, including power on/off, volume, memory access, and electronic lock to prohibit unauthorized use. The keypad area is lighted after any button is pushed to aid readability under low light conditions. The LED numeric and message display provides keypad input feedback to the user and the four status indicators tell about operating conditions. The alert transducer, when enabled, emits a ringing tone, alerting the user of an incoming call. The microphone and speaker provide the functional means for telephone communications. The speaker also provides audible keypad feedback and a low battery warning.

2.2.5 The *DYNA T•A•C* battery pack is a 7.5 V, 800 mAh, nickel-cadmium power source which can provide up to 30 minutes of transmitting and 7-1/2 hours of standby operation before recharging. Recharging can be accomplished through desktop or in-vehicle chargers with the battery pack either attached to the portable telephone, or by itself. Physically, the battery pack is 19.7(H) × 4.1(W) × 1.7(D) centimeters (7.7 x 1.8 x 0.7 inches) and weighs 260 grams (9.2 ounces). The polycarbonate case of the battery pack provides superior impact resistance while the quick release latch holds it securely to the portable. Care should be taken not to expose the battery pack to temperatures greater than 85 °C (185 °F) as the built-in thermal protection circuit will permanently disable the battery.

3. ELECTRICAL FEATURES AND CAPABILITIES

The following highlights detail several of the advanced design and construction techniques employed in the Motorola Cellular radiotelephone. These techniques contribute to the units' operational convenience as well as enhancing the reliability and serviceability of the unit.

- AUTOMATIC OPERATION
  Several operations are handled automatically by the radio such as channel selection, transmit power output regulation, signaling, and MTX (mobile terminal exchange) registration updates.

- MICROCOMPUTER CONTROL
  A single microcomputer controls major radio functions such as frequency selection and synthesis, keypad/transceiver interface, and signaling telemetry encoding/decoding.

- FULL DUPLEX OPERATION
  A ceramic-resonator duplexer isolates the transmit and receive signal paths to provide full duplex operation over a single antenna.

- FULLY SYNTHESIZED
  The transmit and receive injection frequencies are generated by a frequency synthesizer. The synthesizer is referenced to a temperature-compensated crystal oscillator to provide highly-stable output frequencies.

- BATTERY-PROTECTED RAM
  A battery-protected RAM is used to store information such as the locked/unlocked condition of the radio and abbreviated-dialing numbers. The auxiliary battery backup allows the RAM to retain this information when the main battery pack is removed.

- ELECTRONIC LOCK
  The radio can be locked electronically by the user to prohibit unauthorized use. When locked, the radio can be unlocked only by entering the electronic lock code.

- NUMBER ASSIGNMENT MODULE
  The number assignment module (NAM) is an EEPROM (electrically eraseable programmable read-only memory). This non-volatile memory is used to store fixed information for the radiotelephone such as the 3-digit lock code and the subscriber telephone number.

- ADVANCED CIRCUIT DESIGN
  Extensive use has been made of MSI and LSI (medium and large-scale integration) integrated circuits to handle complex decision and control functions. This feature, as well as the use of "chip" components (ultra-small resistors and capacitors), microstrip lines, ceramic resonators, and microminiature construction techniques has contributed to the compact size, light weight, and high reliability of the unit.

- CONVENIENT SERVICING
  Several features have been built into the unit to facilitate service produces. Some of these features are listed below.

  • Vehicle Adapter/Test Connector — A 12-pin connector is provided under the battery pack. This connector provides access to several major test points without opening the radio.

  • Test Mode Operation — A total of 39 commands can be entered via the keypad when connected to the R-2008C Test Set to manually control operation on the transceiver for testing.

  • Minimal Adjustments — By virtue of microcomputer control and fixed-tuned circuitry, very few adjustments are required for proper alignment of the unit. Easy access to those adjustments is provided.

  • Easy Disassembly — Connectors are provided on all lines between circuit assemblies and most modules are easily removed from the chassis for servicing.

  • Replacement/Rechargeable Battery Pack — The rechargeable nickel-cadmium battery pack is easily removed and replaced without tools. Typical charging rates are 10 hours when using the trickle charger or one hour (or less) with the desk top charging unit.

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PORTABLE RADIOTELEPHONE OPERATING INSTRUCTIONS

1. INTRODUCTION

The following information provides an overview of the operation of the *DYNA T•A•C* Portable Telephone and some of its features. To obtain a more comprehensive understanding of its operation and features, refer to the *DYNA T•A•C* Portable Telephone User's Manual (68P81114E44). The information found in Figure 1 may be used as reference while learning the functions and features of the portable telephone.

2. TURNING THE UNIT ON

2.1 The unit is turned on by pressing the **Pwr** (power) button on the keypad. Pressing this button again will turn the unit off. Each time the portable is turned on, the power on indicator illuminates and seven "8's" and the three status messages briefly appear in the Dialed Number and Message Display. Also, a short audio tone will be heard.

2.2 If the unit is unlocked, the **No Svc** (no service) message will illuminate briefly while communication is established with the radiotelephone system. When the link is established, the **No Svc** message will extinguish and the green power on indicator will begin *blinking* to indicate that the unit is ready to place and receive calls.

NOTE

If the **No Svc** message remains on, the unit is out of range of the system and cannot operate.

2.3 If the unit is locked, the green power on indicator will illuminate *steadily* to indicate that the unit must be unlocked before it can be used. ***If the unit is not unlocked, it will automatically turn itself off six seconds after the last key depression.***

3. TURNING THE UNIT OFF

There are two methods which may be used to turn the portable off. The first method is to simply depress the **Pwr** button. This action turns the unit off immediately. The second method that is available is to depress the **Lock** button for 1/2 second, after which, the unit will turn itself off in six seconds (in the locked state). However, when the unit is turned on again, the specific 3-digit unlock (security) code will need to be entered.

4. ELECTRONIC LOCK

(Refer to Table 1.)

4.1 LOCKING THE UNIT

In order to prevent unauthorized calls from being placed or received on the portable telephone, the unit may be electronically locked by depressing the **Lock** button for 1/2 second (until the feedback tone is heard). The lock state is indicated by the steady illumination of the Power Indicator in the Dialed Number and Message Display while all other information in the display disappears. Once the lock state is initiated, the unit will turn itself off in six seconds.

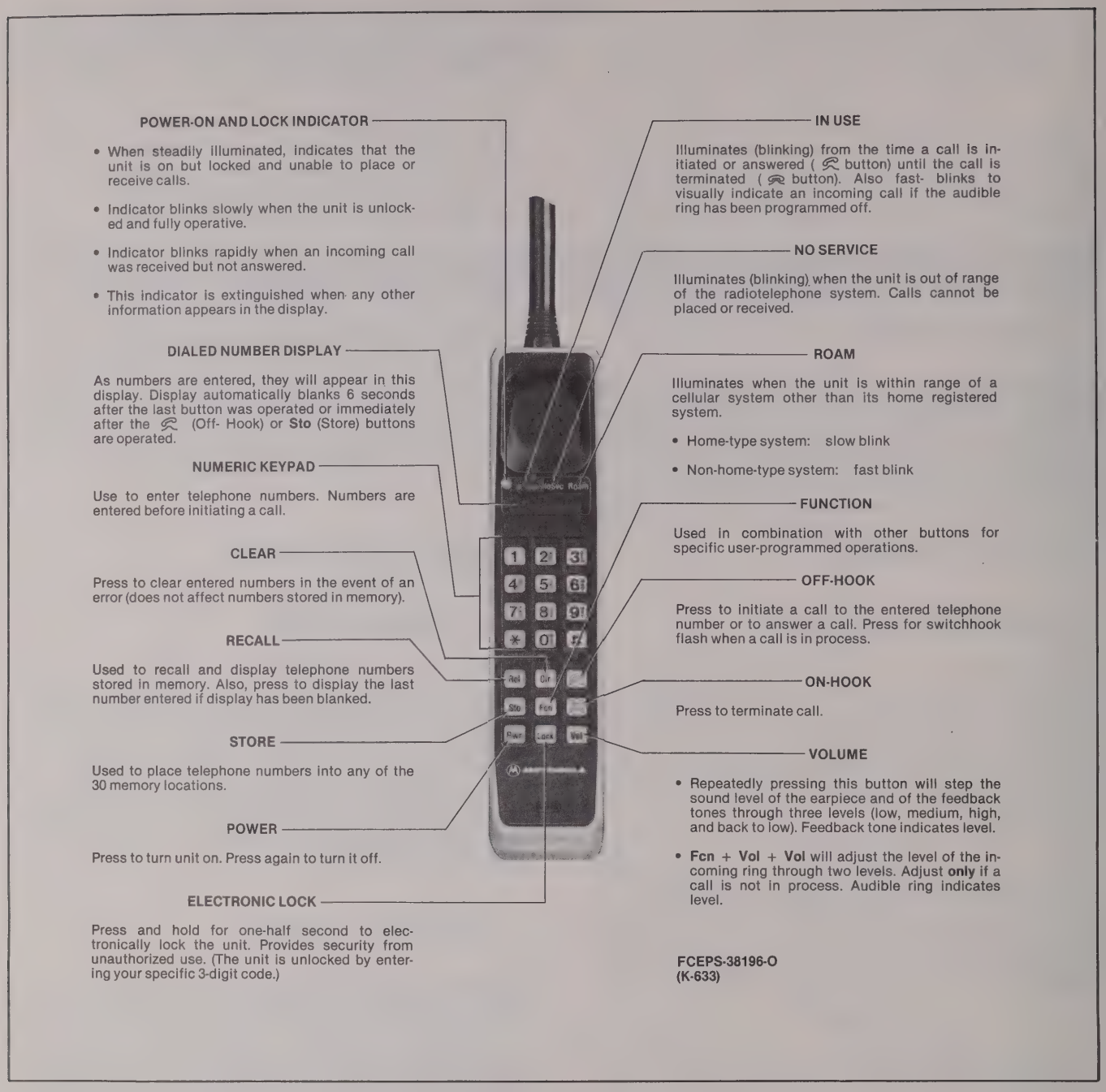
4.2 UNLOCKING THE UNIT

The portable telephone can be unlocked by entering the specific 3-digit lock code after the unit has been turned on. This code must be entered in the proper sequence as a 3-digit group. If an error is made, the procedure can be reset by pressing the **Clr** (clear) button or by turning the unit off and back on, and then restarting the sequence.

4.3 AUTO-LOCK

The portable telephone can be programmed to always be in the locked state when power is turned on without having to operate the **Lock** button prior to every power off action. This mode may be programmed by operating the following key sequence:

Fcn + Lock + Sto


POWER-ON AND LOCK INDICATOR
• When steadily illuminated, indicates that the unit is on but locked and unable to place or receive calls.
• Indicator blinks slowly when the unit is unlocked and fully operative.
• Indicator blinks rapidly when an incoming call was received but not answered.
• This indicator is extinguished when any other information appears in the display.
DIALED NUMBER DISPLAY
As numbers are entered, they will appear in this display. Display automatically blanks 6 seconds after the last button was operated or immediately after the (Off- Hook) or Sto (Store) buttons are operated.
NUMERIC KEYPAD
Use to enter telephone numbers. Numbers are entered before initiating a call.
CLEAR
Press to clear entered numbers in the event of an error (does not affect numbers stored in memory).
RECALL
Used to recall and display telephone numbers stored in memory. Also, press to display the last number entered if display has been blanked.
STORE
Used to place telephone numbers into any of the 30 memory locations.
POWER
Press to turn unit on. Press again to turn it off.
ELECTRONIC LOCK
Press and hold for one-half second to electronically lock the unit. Provides security from unauthorized use. (The unit is unlocked by entering your specific 3-digit code.)
IN USE
Illuminates (blinking) from the time a call is initiated or answered (button) until the call is terminated (button). Also fast- blinks to visually indicate an incoming call if the audible ring has been programmed off.
NO SERVICE
Illuminates (blinking) when the unit is out of range of the radiotelephone system. Calls cannot be placed or received.
ROAM
Illuminates when the unit is within range of a cellular system other than its home registered system.
• Home-type system: slow blink
• Non-home-type system: fast blink
FUNCTION
Used in combination with other buttons for specific user-programmed operations.
OFF-HOOK
Press to initiate a call to the entered telephone number or to answer a call. Press for switchhook flash when a call is in process.
ON-HOOK
Press to terminate call.
VOLUME
• Repeatedly pressing this button will step the sound level of the earpiece and of the feedback tones through three levels (low, medium, high, and back to low). Feedback tone indicates level.
• Fcn + Vol + Vol will adjust the level of the incoming ring through two levels. Adjust only if a call is not in process. Audible ring indicates level.
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(K-633)

Figure 1. DYNA T•A•C Portable Operation Reference Diagram

The unit will now automatically lock every time it is turned off, until it is reprogrammed to return to the normal state by operating the following key sequence:

Fcn + Lock + Clr

Table 1. Summary of Electronic Lock Operation

Action Prior to Turning Power Off	Operational State When Power is Turned On
None	Unlocked
Press **Lock** Button	Locked
Fcn + Lock + Sto	Always Locked
Fcn + Lock + Clr	Determined by **Lock** button

5. BASIC OPERATING INSTRUCTIONS

5.1 DIALING/CALL PLACEMENT PROCEDURES

5.1.1 Placing a Call

Step 1. Turn the portable on and enter the telephone number.

Step 2. Press the (Off-Hook) button and bring the unit up to your ear. The **In Use** message will illuminate.

NOTE

Keypad illumination will go out approximately six seconds after the last button has been depressed.

Step 3. If call placement is successful, proceed with conversation.

Step 4. Press the (On-Hook) button when conversation is completed. The **In Use** message will extinguish.

5.1.2 Reviewing Entered Telephone Numbers

Telephone numbers up to 24 digits in length may be entered from the keypad, although only the final seven digits are normally shown in the display. To review those digits not shown in the display, perform the following:

- To display the first through the seventh digit, press and hold the **Rcl** (recall) button. (The leading digits of a number which exceeds 7 digits.)
- To display the eighth through the fourteenth digit, release the **Rcl** button. (The latter 7-digits of the telephone number.)

Example —

Enter the number 1-312-397-1000. The display will contain 3971000. To review the entire eleven digit number:

Press and hold the **Rcl** button	1312
Release the **Rcl** button	3971000

5.1.3 Dialing Error

A mistake in dialing can only be corrected by depressing the **Clr** button and dialing the complete number again.

5.1.4 Unsuccessful Call Attempts

5.1.4.1 BUSY TONE RECEIVED

If a busy tone is received, press the On-Hook button. To redial (even after a wait time), press the Off-Hook to replace the call. (See Last Number Recall.)

5.1.4.2 RECORDED MESSAGES

Under certain conditions recorded messages may be received. These messages will be self explanatory and usually inform the user why a particular call cannot be completed.

5.1.4.3 REORDER (FAST BUSY) SIGNAL

If a call fails to go through, a *fast busy* signal may be received. This indicates that the telephone system did not process the call, usually because the radiotelephone is in a poor service area. The call attempt should be terminated and tried again. (Press On-Hook, then Off-Hook.)

5.1.4.4 INTERCEPT (SIREN) SIGNAL

The reception of an alternating high and low *siren* signal indicates that *mistake has been made or that the portable telephone is in a "no service" area.* The call attempt should be terminated, check the **No Svc** indicator (should be extinguished), and the Dialed Number Display to see if the telephone number was dialed correctly.

NOTE

An intercept signal may be received if the portable telephone is restricted to placing calls to predetermined areas.

5.2 ANSWERING A CALL

5.2.1 To receive a call, the portable telephone must be turned on and unlocked, and the **No Svc** indicator must be extinguished. When the alerting signal sounds, depress the Off-Hook button and bring the unit up to your ear. The **In Use** message will illuminate.

5.2.2 If an incoming call goes unanswered, the alerting signal will stop, but, the power indicator will begin to *fast-blink*; indicating that a call to the portable was attempted.

5.3 MEMORY DIALING

5.3.1 Last Number Recall
(Replacing a call to the last number dialed.)

This memory feature retains the last telephone number entered into the Dialed Number Display. If a call is terminated after receiving a busy signal, or if the last number is to be re-called, just depress the Off-Hook button to re-initiate the call. To preview the telephone number before replacing the call, depressing the **Rcl** button will display the last number dialed.

5.3.2 Abbreviated Dialing

5.3.2.1 INTRODUCTION

This feature retains up to 30 frequently used telephone numbers. Each telephone number can be stored into a separate memory location (24-digits maximum) and may be recalled from that location and used to place a call. The stored telephone numbers are preserved even if the battery pack is removed from the unit. Numbers are stored in locations 01 through 30 by the user. Location 00 is used as a memory back-up for the last number dialed (stored every time the Off-Hook button is activated). However, all of the 31 memory locations may be recalled by the user.

5.3.2.2 LOADING THE ABBREVIATED DIALING MEMORY

Step 1. With the portable telephone turned on and unlocked, enter the desired telephone number.

Step 2. Momentarily depress the **Sto** (store) button.

Step 3. Enter the desired two-digit memory location (01 through 30). If there is already a number stored in a selected memory location, it will be deleted and the new number stored in its place.

NOTE

The two-digit memory location number must be entered within six seconds of pressing the **Sto** button to implement the store procedure.

Step 4. Repeat the procedure for each number to be stored.

5.3.2.3 REVIEWING STORED NUMBERS

To recall a number stored in the abbreviated dialing memory, press the **Rcl** button followed by the two-digit memory location number.

NOTE

For memory locations 00 through 09, a single digit (0 through 9) may be used instead of the two-digit entry. However, there will be a two second delay before the recalled number will appear in the display.

5.3.2.4 PLACING A CALL USING ABBREVIATED DIALING MEMORY

Step 1. With the portable telephone turned on and unlocked, depress the **Rcl** button.

Step 2. Enter the one- or two-digit memory location (00 through 30). The recalled telephone number will appear in the display.

Step 3. Press the Off-Hook button to process the call. The telephone number will disappear from the display and the green **In Use** message will illuminate.

5.3.3 Scratch Pad Memory

The scratch pad memory allows a new telephone number to be entered during a conversation. This convenience feature eliminates the need for pencil and paper when given a telephone number during a conversation with another party. To use this feature, enter the number via the keypad. The number will automatically be copied into memory thus allowing a call to be place to that number by pressing the Off-Hook button. The number could also be stored into one of the Abbreviated Dialing memory locations if desired.

NOTE

The party at the opposite end of the call should be advised that *Touch Tone®* signaling will be heard through the earpiece as each of the numbers are placed into the scratch pad memory.

6. USER PROGRAMMING INSTRUCTIONS

6.1 EARPIECE VOLUME

Repeated pressing of the **Vol** (Volume) button will step the sound level of the earpiece audio and of the feedback tones through three levels (low, medium, high and back to low). If a call is in progress, pressing the **Fcn** button followed by repeated pressing of the **Vol** button will also reset these levels.

NOTE

The feedback tones from the **Vol** button will not be heard if a call is in progress.

6.2 RING-TONE VOLUME

The volume level of the ring-tone alerting signal can be set to one of two levels when a call *is not in progress*. By pressing the **Fcn** button, followed by repeated pressing of the **Vol** button, the ring-tone can be stepped between the two levels. A ring burst at the actual level will be heard for as long as the **Vol** button is held down.

NOTE

This feature resets after six seconds of key depression.

6.3 DISABLE RING-TONE

6.3.1 The audible ring-tone can be disabled by entering the following pushbutton sequence:

Fcn + 1 + Sto

To enable the ring-tone, enter:

Fcn + 1 + Clr

6.3.2 To compensate for the lack of an audible alert, the **In Use** message will blink fast to signal an incoming call when the audible ring-tone is programmed off.

6.4 DISABLE FEEDBACK TONE

The audible feedback tone can be disabled by entering the following pushbutton sequence:

Fcn + 2 + Sto

To enable the feedback tone, enter:

Fcn + 2 + Clr

6.5 VOICE OPERATED TRANSMISSION (VOX)

VOX operation is a battery saving feature that allows the transmitter to operate only during conversation. To actuate the VOX mode, enter the following pushbutton sequence:

Fcn + 0 + Sto

To disable the VOX mode, enter:

Fcn + 0 + Clr

7. SELECTABLE SYSTEM REGISTRATION

7.1 The selectable system registration feature of the *DYNA T•A•C* Portable Telephone allows the user to change the roam characteristics of the unit. Normally the portable telephone will roam into the same type of system as its home system of registration. However, with the ability of being able to change this characteristic, the unit can be made to roam to a specific system other than its own.

7.2 To change the roam characteristic of the unit, enter the following sequence:

Rcl + * * * . . . + Sto

As each of the *'s are entered, a digit will be displayed corresponding to the roam state (as shown in Table 2). When the desired roam state is achieved, pressing the **Sto** button will program that state into the unit. When programming the Single System Roam (6) characteristic, the System I.D. (SID) of the specific system must be entered into the unit after the digit "6" appears in the display and must be followed by pressing the **Sto** button.

Table 2.
Roam Characteristics of the DYNA T•A•C Portable Telephone

Roam State	Display	Description
Normal	1	Roams to same type of system as its home registered system.
Invert Preference	2	Automatically roams to a non-home type system.
Home Only	3	Unit never roams.
"Scan A"	4	Roams only to RCC non-wireline systems
"Scan B"	5	Roams only to wireline operated systems.
Single System Roam	6	Selects the specific system to roam to.

INSTALLATION

1. INTRODUCTION

1.1 The following information concerns the preparation of the portable telephone for initial operation, not necessarily the installation of the unit in a particular location. Because the portable telephone is intended for portable personal operation, "fixed" installation of the unit is not required. Optional accessories, however, are available for those who wish to operate the portable telephone in a vehicle operating with extended range. Vehicular installation procedures are provided in the instruction manual for these options. Contact a Motorola representative for more information on this and other options available for the portable telephone.

1.2 Preparation of the portable telephone includes the programming of the assigned telephone number and the initial charging of the nickle-cadmium battery pack. These procedures are outlined in the following paragraphs. After preparing the portable telephone, ensure that the unit is operational by making several test calls.

NOTE

Refer to the Operating Instructions section of this manual for operating procedures.

2. TELEPHONE NUMBER PROGRAMMING

The assigned portable telephone number and other data are programmed electronically by the service/installation personnel. The actual programming entails programming the NAM EEPROM (p/o the ID module) with the proper information using a Motorola Model R-1801 Digital Analyzer/Controller (includes the reader/programmer capability) equipped with applicable adapter module and application package (includes instruction manual). Refer to the manual supplied with the R-1801 for the procedure for program ming the telephone number.

3. BATTERY CHARGING

The portable telephone is equipped with a rechargeable nickle-cadmium battery pack, which should be charged at the full charging rate before placing the unit into service. Complete battery care and charging information are located in section 68P81049E56 of this manual.

DYNA T•A•C PORTABLE TELEPHONE RECHARGEABLE BATTERY PACK

MODEL TNN6000A

1. INTRODUCTION

1.1 The TNN6000A Battery Pack, shown in Figure 1, is a 7.5V, 800 mAh, nickel-cadmium power source capable of 30 minutes of transmitting and 7.5 hours of standby operation before recharging. Recharging can be accomplished through desktop or in-vehicle chargers with the battery pack either attached to the portable telephone, or by itself.

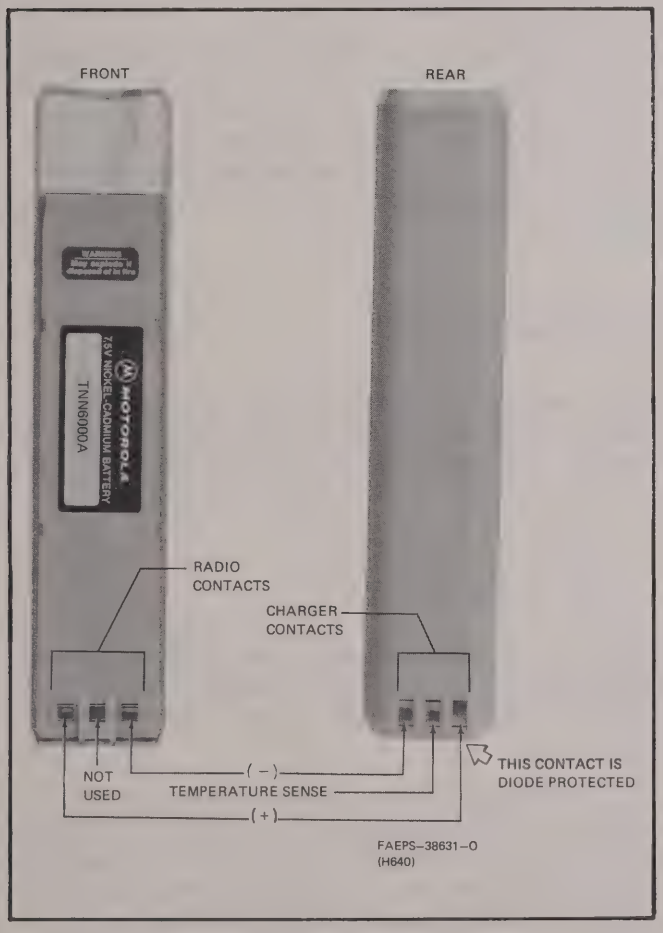

Figure 1. TNN6000A Battery Pack

1.2 Physically, the battery pack is 19.7(H) × 4.1(W) × 1.7(D) centimeters (7.7 × 1.8 × 0.7 inches) and weighs 260 grams (9.2 ounces). The polycarbonate case of the battery pack provides superior impact resistance while the quick release latch holds it securely to the portable telephone.

2. BATTERY OPERATION

The rechargeable nickel-cadmium battery pack will provide approximately 8 hours of normal operation between charges. Normal operation assumes ten 3-minute telephone calls with the unit operating standby — unit on but not engaged in telephone calls—the rest of the time. VOX operation (described in section 68P81049E49 of this manual) will approximately double the number of 3-minute calls (assuming 1-1/2 minutes talking and 1-1/2 minutes listening).

3. CHARACTERISTICS

3.1 The nickel-cadmium battery pack consists of 6 cells connected in series to provide a nominal 7.5 V dc output. A device internal to the battery pack provides thermal protection.

CAUTION

When the battery pack is removed from the portable unit *do not* allow the battery terminals to become shorted together (e.g., a paper clip placed accidentally across the battery contacts). Sustained high rate discharges permanently damages the battery, voids the battery warranty, and may create a burn or fire hazard.

3.2 The voltage of a nickel-cadmium battery remains approximately constant under load until the battery approaches the discharged condition. At this time, a marked decrease in the voltage occurs and the discharged condition (1.0 V per cell) is reached abruptly. Metering to determine the state of charge in this type of battery is difficult and is not normally performed.

3.3 A general characteristic of all rechargeable batteries in storage is self discharge. If the battery is used after unknown periods of storage, it is recommended that it be charged at the full charging rate using an approved battery charger.

WARNING
Battery may explode if disposed of in fire.

4. BATTERY CHARGING

4.1 TRICKLE CHARGING

The TPN6157A AC Charger supplied with the portable telephone will recharge the battery pack in approximately 10 hours. A yellow LED indicator on the charger base is illuminated during the charging cycle. To recharge the portable telephone battery, place the entire unit or just the battery pack into the cup of the charger base (see Figure 2.).

Figure 2. Portable Telephone Placed in Trickle Charger Base

4.2 ONE-HOUR CHARGING

The optional TLN2690A AC Fast Charger may be used to recharge the portable telephone battery pack in 1-hour or less. A red LED indicator illuminates during the charging cycle. A green LED indicator illuminates when the charging cycle is complete. To recharge the portable telephone battery, place the entire unit or just the battery pack into the cup of the desk top unit.

4.3 CHARGING TEMPERATURE

Battery charging should occur with the battery pack at about 77 °F (room temperature) whenever possible. Charging a cold battery (below 45 °F) may result in leakage of electrolyte, and ultimately, in failure of the battery. Charging a hot battery (above 95 °F) results in reduced discharge capacity, affecting the performance of the portable telephone. The Motorola recommended rapid-rate battery chargers contain a temperature sensing circuit to ensure the battery is charged within these temperature limits.

5. BATTERY MAINTENANCE

The only maintenance required is recharging the battery and keeping the contacts clean. Use only a Motorola approved charger. The use of other chargers, unless approved, will void the battery guarantee and may result in permanent damage to the battery and the radio. Follow the charging instructions which accompany each charger.

6. STORAGE

Battery packs may be stored at room temperature in any state of charge without damage. As previously stated, however, the battery is subject to self discharge and should be recharged after extended storage.

7. MEMORY EFFECT

7.1 A nickel-cadmium battery may exhibit a reduced charge capacity (memory effect) caused by continuous overcharge for long periods or repetitive shallow cycling.

7.2 If the battery pack is lightly or infrequently used and is allowed to charge over a long period (30-60 days), it may develop memory effect. That is, the voltage may be sufficiently lowered on the first discharging cycle to reduce the effectiveness of radio transmission.

7.3 A more common type of memory effect is induced by uniform shallow cycling. For example, if the battery is operated so that it repeatedly delivers 50% of its full capacity, it can temporarily become inactive, and when

current demand is increased, it may show a sharp decrease in its ability to deliver proper terminal voltage.

7.4 If the battery is exhibiting memory effect, memory can be easily eliminated by completely discharging the battery (deep discharge), and recharging again. One or two deep discharge cycles are usually sufficient to restore the battery to full capacity.

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PORTABLE TELEPHONE DISASSEMBLY INSTRUCTIONS

1. INTRODUCTION

To perform some of the troubleshooting procedures required in the maintenance of the portable telephone, the unit must be disassembled in order to gain access to the various internal components. Then the disassembled unit must be placed in the test fixture RTL-4155A to continue the troubleshooting procedures. Reasonable care should be taken during the disassembly and reassembly of the unit in order to avoid damaging or stressing the housing and internal components. Motorola recommends the use of a properly grounded high impedance conductive wrist strap while performing these procedures.

CAUTION

Many of the integrated circuit devices used in this equipment are vulnerable to damage from static charges. Care must be taken in handling, shipping, and servicing them and the assemblies in which they are used.

2. RECOMMENDED TOOLS

The following tools are recommended for use during the assembly/disassembly of the portable telephone.

- Assembly/Disassembly Fixture (RTL-4152A)
- Anti-Static Mat Kit (RPX-4307A)
  includes:
  Anti-Static Mat 66-80387A95
  Ground Cord 66-80387A98
  Wrist Band 42-80385A59
- Tool Kit (RPX-4306A)
  includes:
  Torque Wrench, Adjustable 10-120 in. oz. 66-80321B53
  Screwdriver Allen Hex 66-80321B54
  2mm Allen Hex Socket 66-80321B55
  TORX® T6 Bit (STD) 66-80387A70
  TORX® T6 Bit (1-15/16 long) 66-80321B56
  TORX® T8 Bit (STD) 66-80387A72
  4mm Thin-Wall Hex Head Socket 66-80321B57
  Coaxial Connector Tool 66-80321B58
  Antenna Bushing Tool 66-80321B61
  CVC Clip Tool 66-80321B59
  Microphone Tool 66-80321B60

NOTE

Refer to the mechanical exploded view as necessary, while performing the following procedures.

3. UNIT DISASSEMBLY PROCEDURE

Removing Module Interconnect Board

Step 1. Turn off the portable telephone.

Step 2. While pushing the spring-loaded battery latch (located on bottom) towards the front of the unit, slide the battery pack down by applying pressure to its top.

NOTE

When the battery pack is removed, the 4 housing screws and the connector retaining clip are exposed.

Step 3. Remove the antenna by unscrewing it counterclockwise.

Step 4. Remove the coaxial connector inside the antenna mount assembly by inserting tool (Motorola part number 66-80321B58) into antenna connector and turning counterclockwise. See Figure 1.

NOTE

To remove the coaxial connector after it is loosened, turn the unit upside down and let the connector fall into your hand.

Step 5. Remove the retaining clip that holds the rf switch and connector (CVC assembly) to the center housing, using tool 66-80321B59. See Figure 2.

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Step 6. Place unit into assembly/disassembly fixture (Motorola part number RTL-4152A) as shown in Figure 3.

Figure 1. Coaxial Connector Removal

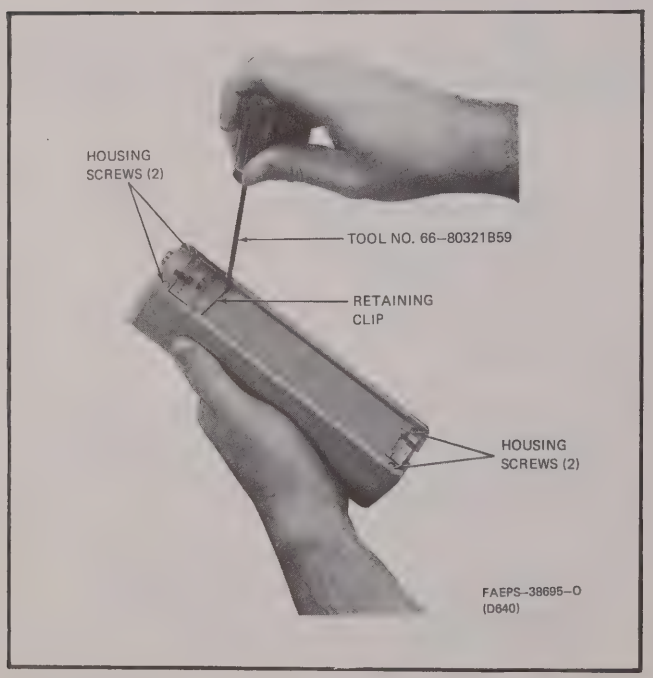


Figure 2. Retaining Clip Removal

Step 7. Remove the 4 housing screws by rotating each counterclockwise. Refer to Figure 2.

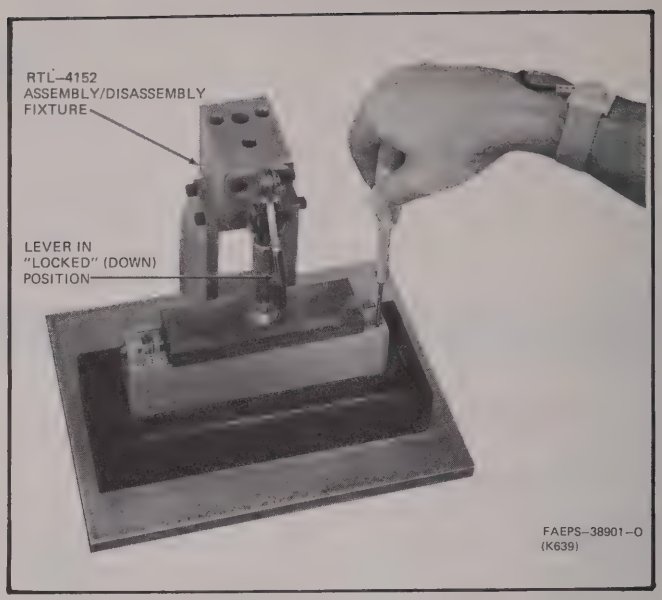


Figure 3. Portable Telephone in Assembly/Disassembly Fixture

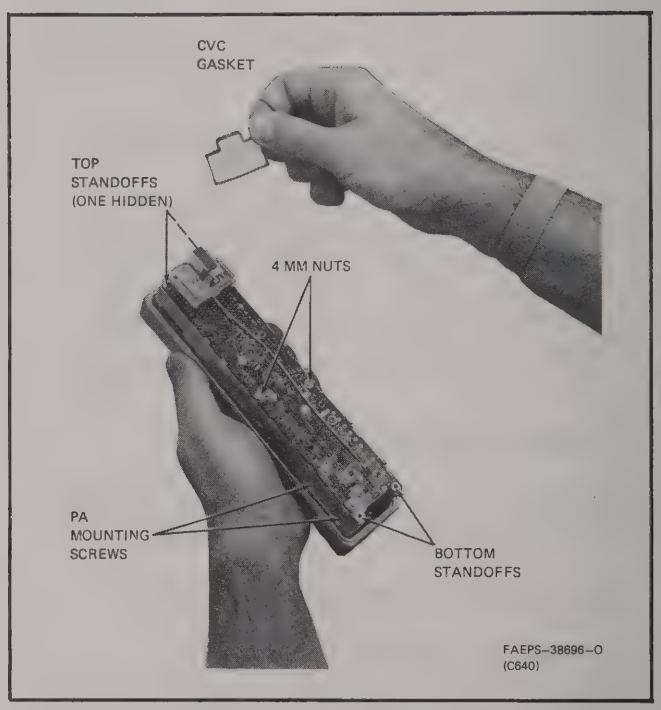


Figure 4. Portable Telephone with Center Housing and CVC Gasket Removed

NOTE

Refer to Figure 4 while performing Steps 8-12.

Step 8. Separate the housing by firmly holding the front housing with one hand and grasping the center housing with the other, while applying pressure to the CVC assembly with forefinger. Once separated, remove the CVC gasket.

Step 9. Remove the two 4mm nuts located at the center edges of the interconnect board using tool 66-80321B55.

CAUTION

The hardware to be removed in Steps 9 and 10 is reverse threaded and must be removed by turning ***clockwise***. If turned the wrong way, and tightened in excess of torque specifications, permanent damage to these items may result.

Step 10. Remove the two threaded standoffs located at the bottom edge of the interconnect board by turning each ***clockwise*** (reverse threaded) using tool 66-80321B54.

Step 11. While holding grounding clip and using same tool as in Step 10, remove the two threaded standoffs located at the top edge of the interconnect board by turning each ***clockwise***; then remove grounding clip.

NOTE

Top standoffs are different length than bottom standoffs.

Step 12. Locate and remove the two PA mounting screws on the side of the metal frame using tool 66-80321B53.

Step 13. While holding the front assembly in one hand, grasp the edges of the interconnect board and, using a rocking motion, remove the board.

Front Housing Disassembly

Step 14. With the assembly face-down, remove the shock pad and insulator by pulling out toward the top of the unit.

Step 15. Remove the 4 screws that hold the frame to the front housing using tool 66-80321B53 and remove the frame.

Step 16. Carefully lift the circuit board from the front housing, avoiding excessive tension on the wires connected to the opposite side of the board.

Step 17. Disconnect the two 2-pin connectors (J/P101-A and J/P101-B) that connect the speaker and alert assemblies to the keyboard.

Step 18. Disconnect the 3-pin connector (J/P102) that connects the microphone assembly to the keyboard.

Step 19. Remove the alert assembly by placing a small flat-blade screwdriver under the alert mounting bracket and prying up. Refer to Figure 5.

Figure 5. Alert Transducer Removal

CAUTION

Do not pull on the wires of the alert assembly. Handle the bracket only.

Step 20. Remove the mounting screws from the speaker assembly using tool 66-80321B53 and remove the assembly from the housing.

CAUTION

Do not hold the speaker assembly by the wires.

Step 21. Remove the microphone assembly by grasping the mount with thumb and forefinger, then lift from the housing.

NOTE

Further disassembly of the front housing is not recommended unless absolutely necessary.

4. MODULE REMOVAL

4.1 The majority of the modules plug into connectors on the interconnect board, which are easily removed with two fingers. However, some of these modules require the removal of mounting screws or nuts which are accessed on the solder side of the interconnect board, while other modules are soldered into the interconnect

board. The information found in Table 1 and Figure 6 can be referred to as an aid in the identification of the individual modules.

Table 1. Module Identification

Model No.	Description	Label or Stamp
TFN6048A#	45 MHz Filter	TFN6048A
TLF6591A#	Power Amplifier	TLF6591A
TRN5808A	Logic Unit	95E26
TRN5823A	Receive Audio	95E10
TRN5824A	Transmit Audio	95E11
TRN5825A	DC Control	95E12
TRN5826A	SAT	95E13
TRN5827A#	VCO	95E15
TRN5828A	PLL	95E16
TRN5829A	Receive Multiplier	95E18
TRN5830A	Phase Modulator	95E17
TRN5831A	I-F	95E23
TRN5832A	RF Amplifier	95E20
TRN5833A	Mixer	95E22
TRN5834A#*	Isolator	TRN5835A
TRN5835A	AOC	95E24
TRN5836A*	ID	95E14
TRN5837A#	Antenna Duplexer	TRN5837A
TRN5840A*	Mixer Duplexer	95E21
TRN5841A#	Transmit Multiplier	95E19
TRN9123A*	Reference Oscillator	KXN1119AA

*These modules are soldered to the interconnect board.
#These modules are attached to circuit board by 1 or more screws or nuts.

4.2 To remove a particular module, first make certain that the mounting hardware is removed (if used) or any soldered pins are unsoldered. Then, while grasping the module with thumb and forefinger, lift the module from the interconnect board using a rocking motion. Those modules having an orientation key may be removed by pressing these points from the solder side of the interconnect board. When replacing a module, pay particular attention to the orientation of the interconnecting pins. ***These pins are fragile and easily bent if care is not heeded when replacing the module.***

5. UNIT REASSEMBLY

NOTE
Service personnel should be familar with all of the following information before attempting reassembly of the portable telephone.

Front Housing Assembly

IMPORTANT
Inspect the microphone screen and replace if necessary.

Step 1. Install the microphone assembly in its location in the lower portion of the front housing and press into place.

CAUTION
Do not hold the speaker assembly by the wires.

Step 2. Place the gasket and speaker assembly in its location in the upper portion of the housing and install the mounting screws. Torque screws to 26 in. oz.

IMPORTANT
Inspect the alert transducer screen and replace if necessary.

Step 3. Install the alert assembly in its location in the top of the front housing by pressing the mounting bracket on the posts.

CAUTION
Do Not pull on the wires of the alert assembly. Handle the bracket only.

Step 4. Connect the 3-pin microphone connector (P102) to connector J102 on the keyboard.

Step 5. Connect the two 2-pin connectors (J/P101-A and J/P101-B) that connect the speaker and alert assemblies to the keyboard, matching the numbers labeled on the connector halves.

Step 6. Carefully place the keyboard circuit board in the front housing.

Step 7. With the front housing assembly face down, place the metal frame on top of the circuit board (with the 4 mounting tabs against the circuit board).

Step 8. Install the 4 screws that hold the frame and circuit board to the front housing. Torque the top 2 screws (speaker end) to 26 in.-oz. Torque the bottom 2 screws (microphone end) to 32 in.-oz.

Step 9. Install the insulator and shock pad inside the frame.

Installing Module Interconnect Board

Step 10. Install the interconnect board on the rear of the assembly while observing the alignment of the 16-pin connection (J/P3) through the window opening in the frame.

NOTE
Refer to Figure 4 while performing steps 11-15.

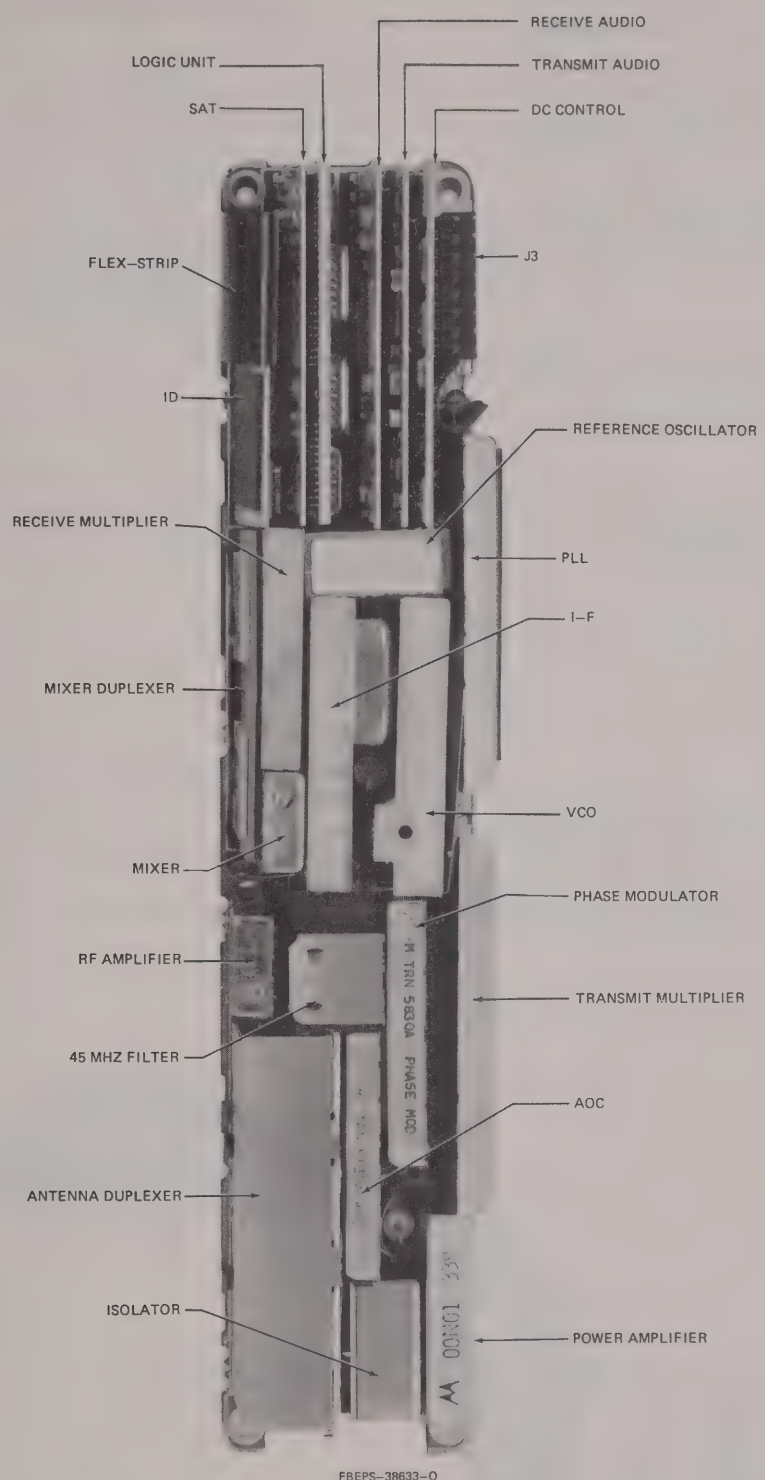


Figure 6. Interconnect Board Module Locations

CAUTION

The hardware installed in Steps 10 and 11 is left-hand (reverse) threaded and must be installed by turning ***counter-clockwise***. If turned the wrong way, and/or tightened in excess of torque specifications, permanent damage to these items may result.

Step 11. While holding the grounding clip in place, install the two long, threaded standoffs at the top edge of the interconnect board. Turn each standoff counter-clockwise until the interconnect board is just seated on the frame.

Step 12. Install the two short, threaded standoffs at the bottom edge of the interconnect board. Turn each standoff counter-clockwise until the interconnect board is just seated on the frame.

Step 13. Install the two 4mm hex head nuts on the threaded posts located at the center edges of the interconnect board and torque to 26 in.-oz.

Step 14. Install the two PA mounting screws on the side of the metal frame and torque to 26 in.-oz.

Step 15. Install the CVC gasket on the rf switch and connector (CVC) assembly.

Step 16. Join the housing assemblies together by holding the front housing with one hand and grasping the center housing with the other, while guiding the CVC assembly with the forefinger. *Make certain that the O-ring does not fall out of its groove.* See Figure 7.

CAUTION

Inspect the housing O-ring and replace if obvious damage exists.

Step 17. Place the unit in the assembly fixture as shown in Figure 3. Guide the CVC assembly into place by pulling gently on the rf switch housing and inspect the O-ring again before closing the assembly fixture clamp.

Step 18. Insert tool through one of the four screw holes in the corners of the center housing and turn the standoff ***clockwise*** until a slight resistance is felt (standoff against the inside of the center housing). ***Do not over tighten.***

Step 19. Repeat Step 18 for each standoff.

Step 20. Install the 4 housing screws and washers through the center housing and into each of the 4 standoffs. These are conventional threaded screws and are torqued to 26 in.-oz.

Step 21. Install the rf switch and connector (CVC) assembly retaining clip using tool 66-80321B59. See Figure 2.

Step 22. Install the coaxial connector inside the antenna mount assembly using tool 66-80321B58 and torque to 22 in.-oz. See Figure 1.

Step 23. Install the antenna and battery pack.

Step 24. Ensure operation of the portable telephone.

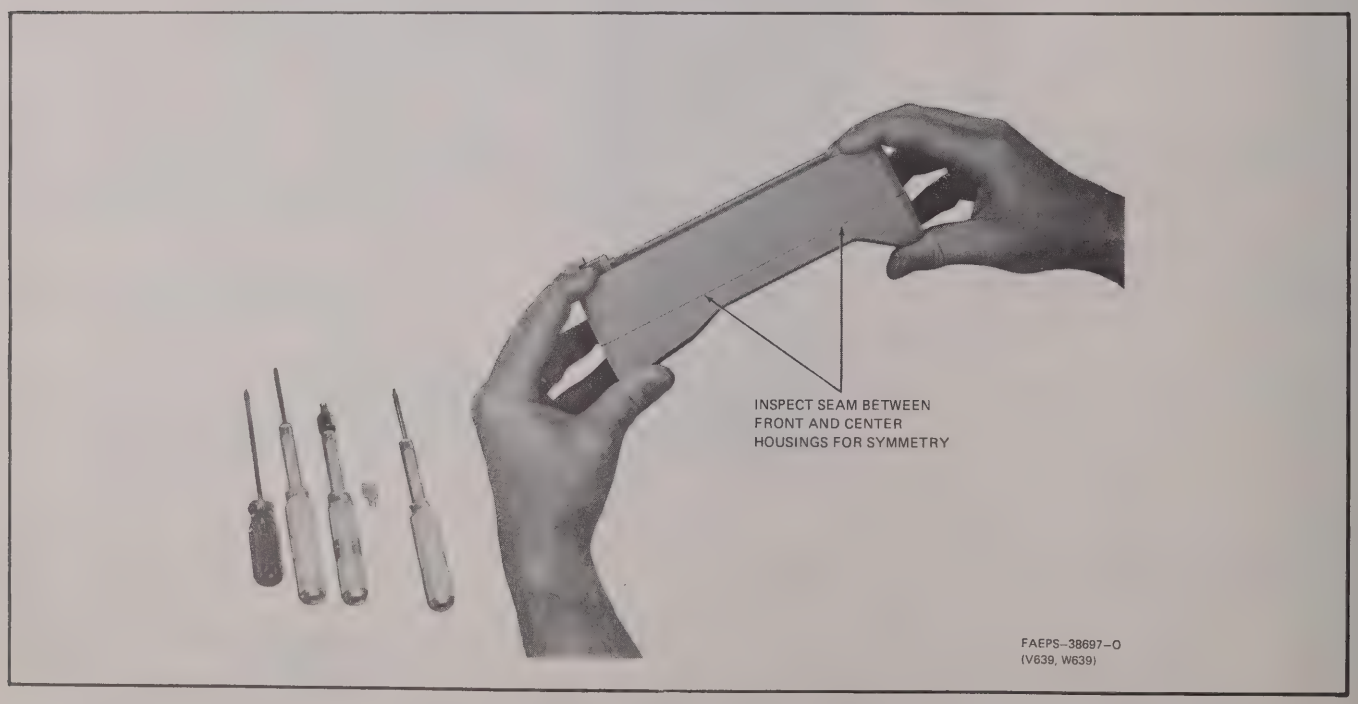
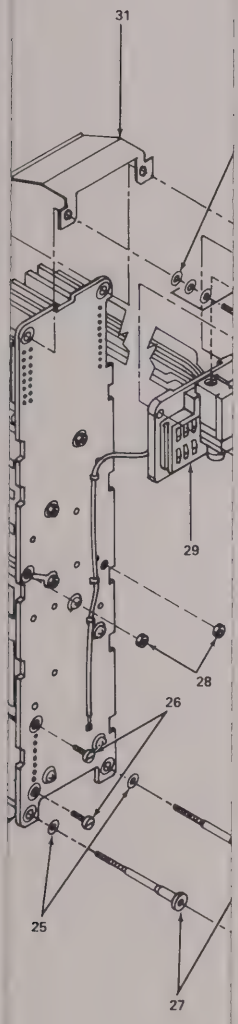


Figure 7. Inspecting the Portable Telephone Housing

MECHANICAL PARTS

(EXPLODED VIEW)

	DESCRIPTION
	machine: M2 x 0.4 x 5mm
	R TOR: 1.75 x 0.65 x .063"
	TOR: 1.8 x 0.45 x .045" AMPLIFER DR TOR: 1.15 x 0.65 x .045" TOR: 1.4 x 0.9 x 0.125" TOR: 0.9 x 0.15 x .031" TOR: 0.8 x 0.4 x .031" TOR: .09 x 0.6 x .062" IA, duplexer



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CAUTION

The hardware installed in Steps 10 and 11 is left-hand (reverse) threaded and must be installed by turning ***counter-clockwise***. If turned the wrong way, and/or tightened in excess of torque specifications, permanent damage to these items may result.

Step 11. While holding the grounding clip in place, install the two long, threaded standoffs at the top edge of the interconnect board. Turn each standoff counter-clockwise until the interconnect board is just seated on the frame.

Step 12. Install the two short, threaded standoffs at the bottom edge of the interconnect board. Turn each standoff counter-clockwise until the interconnect board is just seated on the frame.

Step 13. Install the two 4mm hex head nuts on the threaded posts located at the center edges of the interconnect board and torque to 26 in.-oz.

Step 14. Install the two PA mounting screws on the side of the metal frame and torque to 26 in.-oz.

Step 15. Install the CVC gasket on the rf switch and connector (CVC) assembly.

Step 16. Join the housing assemblies together by holding the front housing with one hand and grasping the center housing with the other, while guiding the CVC assembly with the forefinger. *Make certain that the O-ring does not fall out of its groove.* See Figure 7.

CAUTION

Inspect the housing O-ring and replace if obvious damage exists.

Step 17. Place the unit in the assembly fixture as shown in Figure 3. Guide the CVC assembly into place by pulling gently on the rf switch housing and inspect the O-ring again before closing the assembly fixture clamp.

Step 18. Insert tool through one of the four screw holes in the corners of the center housing and turn the standoff ***clockwise*** until a slight resistance is felt (standoff against the inside of the center housing). ***Do not over tighten.***

Step 19. Repeat Step 18 for each standoff.

Step 20. Install the 4 housing screws and washers through the center housing and into each of the 4 standoffs. These are conventional threaded screws and are torqued to 26 in.-oz.

Step 21. Install the rf switch and connector (CVC) assembly retaining clip using tool 66-80321B59. See Figure 2.

Step 22. Install the coaxial connector inside the antenna mount assembly using tool 66-80321B58 and torque to 22 in.-oz. See Figure 1.

Step 23. Install the antenna and battery pack.

Step 24. Ensure operation of the portable telephone.

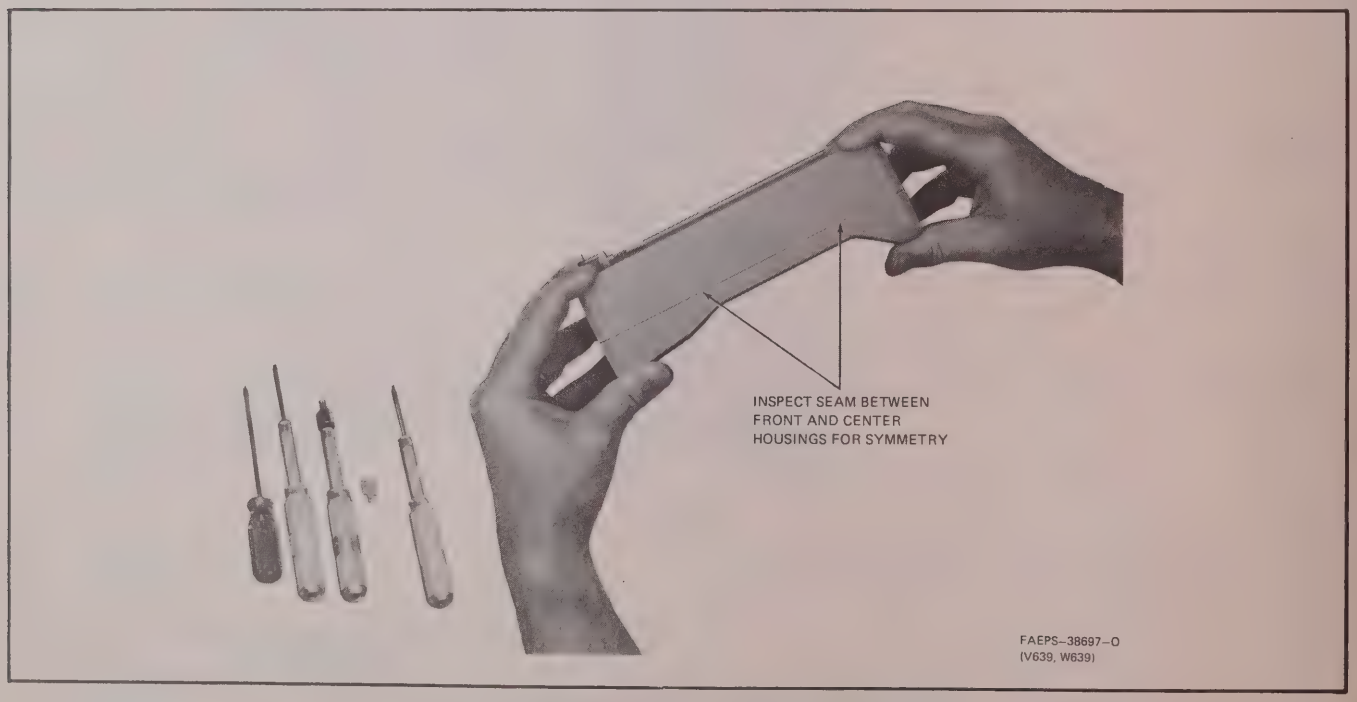


Figure 7. Inspecting the Portable Telephone Housing

SYSTEM TROUBLESHOOTING

1. INTRODUCTION

The following system troubleshooting information is designed to aid service personnel in isolating perceived malfunctions to a single module within the portable telephone. The suspected module is then replaced and the portable telephone can be returned to service after ensuring that the unit complies with published specifications (see alignment procedure). Before attempting these procedures, however, the service personnel should be completely familiar with the normal operation of the equipment and have access to a suitably equipped test bench.

2. RECOMMENDED TEST EQUIPMENT

A list of recommended test equipment for maintaining the portable telephone is given in the following text. This equipment is used by service personnel during the performance of maintenance duties.

- Communications system analyzer — Motorola Model R-2008. Includes: variable tap rf coupler, junction box with interface unit, and associated cabling.
- Test fixture — Motorola Module RTL-4155A.
- Rear mount test adapter — Motorola Model RTL-4153A.
- Digital analyzer controller — Motorola Model R-1801.
- Step attenuator — Hewlett-Packard Models 335C and 335D or equivalent.
- RF millivolt meter — Motorola Model S-1339, S-1340 or equivalent.
- RF probe with cable and connector — (Motorola part number 1-83554F64) and probe tip with grounding clip (Motorola part number 1-83554F65.)
- Digital multimeter — Motorola Model R-1024 or equivalent.
- Oscilloscope — Motorola Model R-1029 or equivalent.
- Power supply — Motorola Model S-1348 or equivalent.
- AC voltmeter — Motorola Model S-1053 or equivalent.
- Miscellaneous cables and jumpers.
- Anti-static mat kit (RPX-4307A)
  includes:
  Anti-static mat 66-80387A95
  Ground cord 66-80387A98
  Wrist band 42-80385A59

3. TROUBLESHOOTING PROCEDURE

3.1 OVERVIEW

3.1.1 Troubleshooting and repair of the portable telephone mainly concerns the identification and replacement of defective modules within the unit. Tables 2 through 22 provide symptom related troubleshooting information. The information found in Table 1 is used to quickly locate the troubleshooting information for a particular symptom. It should be noted that the procedures found in Tables 4, 5 and 14 can be used on a fully assembled radio if configured as shown in Figure 1. The photos in Figures 2 and 3 show the module interconnect board removed from the portable housing, revealing module and adjustment locations, connectors, and physical orientation.

WARNING

The lithium battery used in the radio for memory retention must be treated with the following precaution:

- DO NOT short circuit the battery.
- DO NOT attempt to recharge the battery.
- DO NOT dispose of battery in fire or allow battery to get close to extreme heat.

Failure to observe these precautions could result in explosion of the battery and possible damage to equipment and/or injury to personnel.

3.1.2 Whenever a module in the portable telephone is replaced, it is important that the alignment procedure be performed (see section 4). This will ensure that the repaired unit complies with the operating specifications.

3.2 TEST SET-UP

3.2.1 General

3.2.1.1 To initiate a particular test, the R-2008 System Analyzer is configured as described in either 3.2.2 or 3.2.3. The diagram of Figure 1 shows a typical bench test set-up of the test equipment used to properly troubleshoot a fully assembled portable telephone. The output of the analyzer should be calibrated in order to provide the proper input level at the antenna input of the portable telephone when performing receiver tests. Refer to the R-2008 Operator's manual for additional information.

3.2.1.2 The troubleshooting of suspect modules requires disassembly of the portable telephone, as described in section 68P81049E52 of this manual. The interconnect board must be removed from the housing assembly and placed in a test fixture RTL-4155A. Then the rear mount test adapter (RTL-4153A) is attached to connector J202 of the flex-strip. An extender cable connects between J3 of the interconnect board and P3 of the keyboard to provide this interconnection. ***Do not remove keyboard from the front housing assembly***!

3.2.1.3 When the portable telephone is connected to the rear mount test adapter alone or with the test fixture and adapter, it is capable of being placed in the self-test mode. In this mode, the portable telephone keypad is used to enter commands to select such parameters as operating channel, power level, etc. Complete details of the self-test mode are provided in the Self-Test Mode Operating Instructions section (68P81049E57).

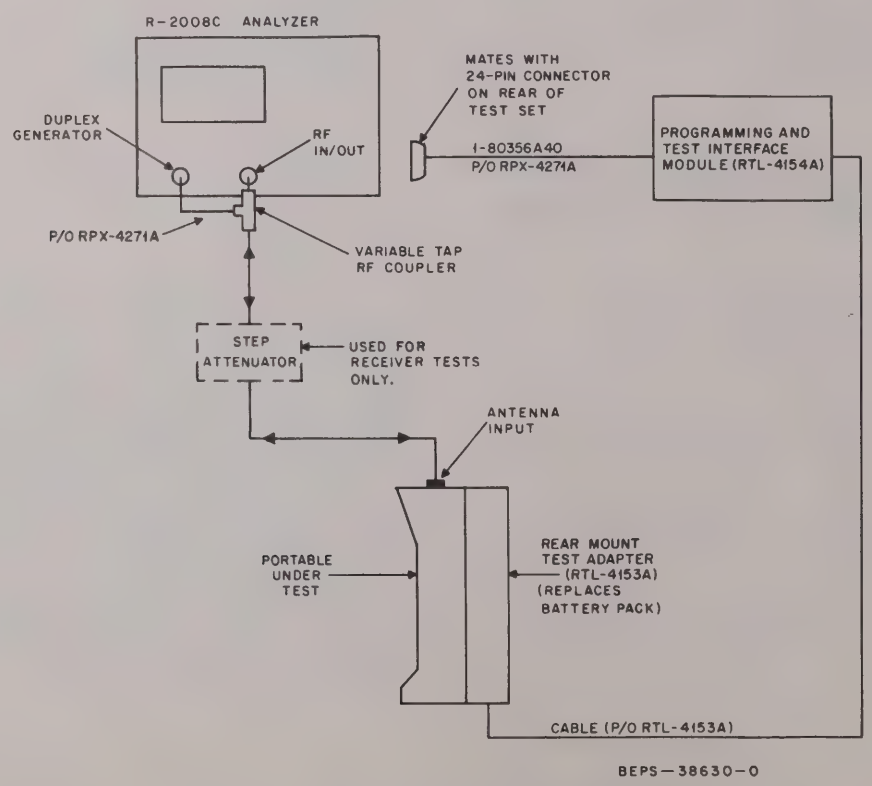


Figure 1. System Test Equipment Set-Up

3.2.2 R-2008C Signaling Sequence Test Connection

The signaling sequence test mode will allow the portable to be tested under actual operating conditions. In this mode the system analyzer will be capable of conducting 3 major tests:

1. Unit initiation of service request message.
2. Land originated calls (pages).
3. Portable originated calls.

These tests require that only an rf connection be made to the system analyzer. A coaxial cable should be connected directly from the portable antenna connector to the variable tap rf coupler on the system analyzer. The battery pack can remain on the unit, or the test interface may be used instead.

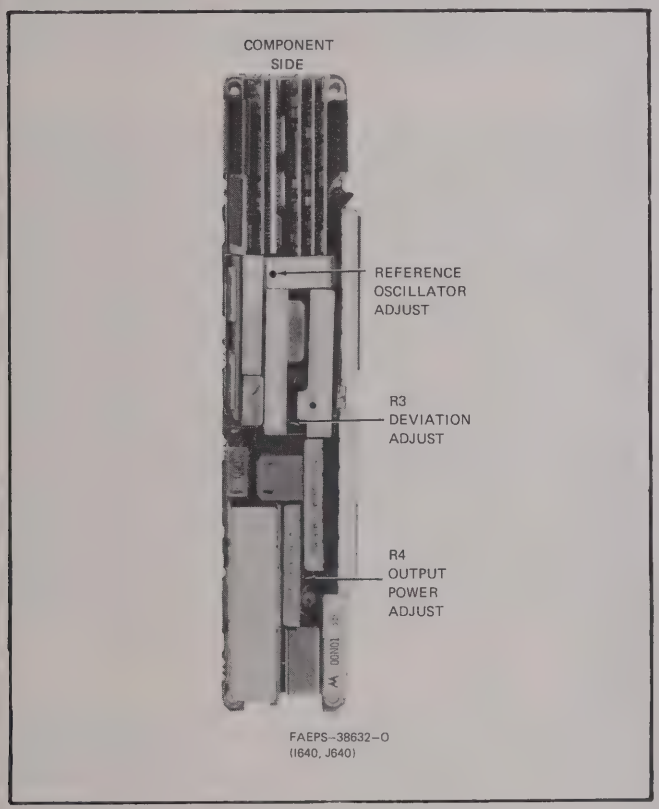


Figure 2. Location of Adjustment Controls

3.2.3 R-2008C Manual Test Mode Connection

3.2.3.1 The manual test mode allows the service technician to seize manual control of the portable. The test equipment configuration is shown in Figure 1. The variable attenuator should be used only for receiver sensitivity tests. In all other tests the rf output of the portable should be connected directly to the variable tap rf coupler of the system analyzer.

3.2.3.2 In the manual test mode, the test interface must be used in place of the battery pack. This will allow the unit to be controlled either through built-in keyboard test commands or through the system analyzer manual test mode. See the R-2008C Operator's Manual for the procedures required to invoke these manual test modes.

Table 1. Troubleshooting Symptom Location

Table No.	Symptom
2A	Radio does not turn on.
2B	Radio does not turn off.
3	Radio turns on and places a number in right-hand side of display.
4*	Keypad produces feedback, but no digits appear in the display.
5*	Keypad produces digits, but no feedback.
6	No ring alert.
7	No receive audio or feedback tones heard from earpiece.
8	No receive audio and no tones from connector J202 pin 4 (EXT EAR).
9	No tones, but there is receive audio.
10	No (or distorted) receive audio, but there are tones.
11	Radio can not get service on test system.
12	Receiver produces noise but does not quiet, or has poor sensitivity.
13	Low or no RSSI readings.
14*	Radio will not complete call and/or lacks modulation from one or more of the following: Tx SAT, Tx data, Tx DTMF or Tx audio.
15	No (low) power out.
16	No transmit modulation of any kind.
17	Both internal MIC and EXT MIC from J202 do not produce modulation, but Tx SAT, Tx data, and Tx DTMF modulation are produced.
18	Internal MIC does not produce modulation but EXT MIC from J202 does produce modulation.
19	Tx SAT produces no modulation.
20	Tx data produces no modulation.
21	Tx DTMF produces no modulation.
22	No sidetone.

* indicates that test can be performed on a fully assembled radio. All other tests must have center housing removed.

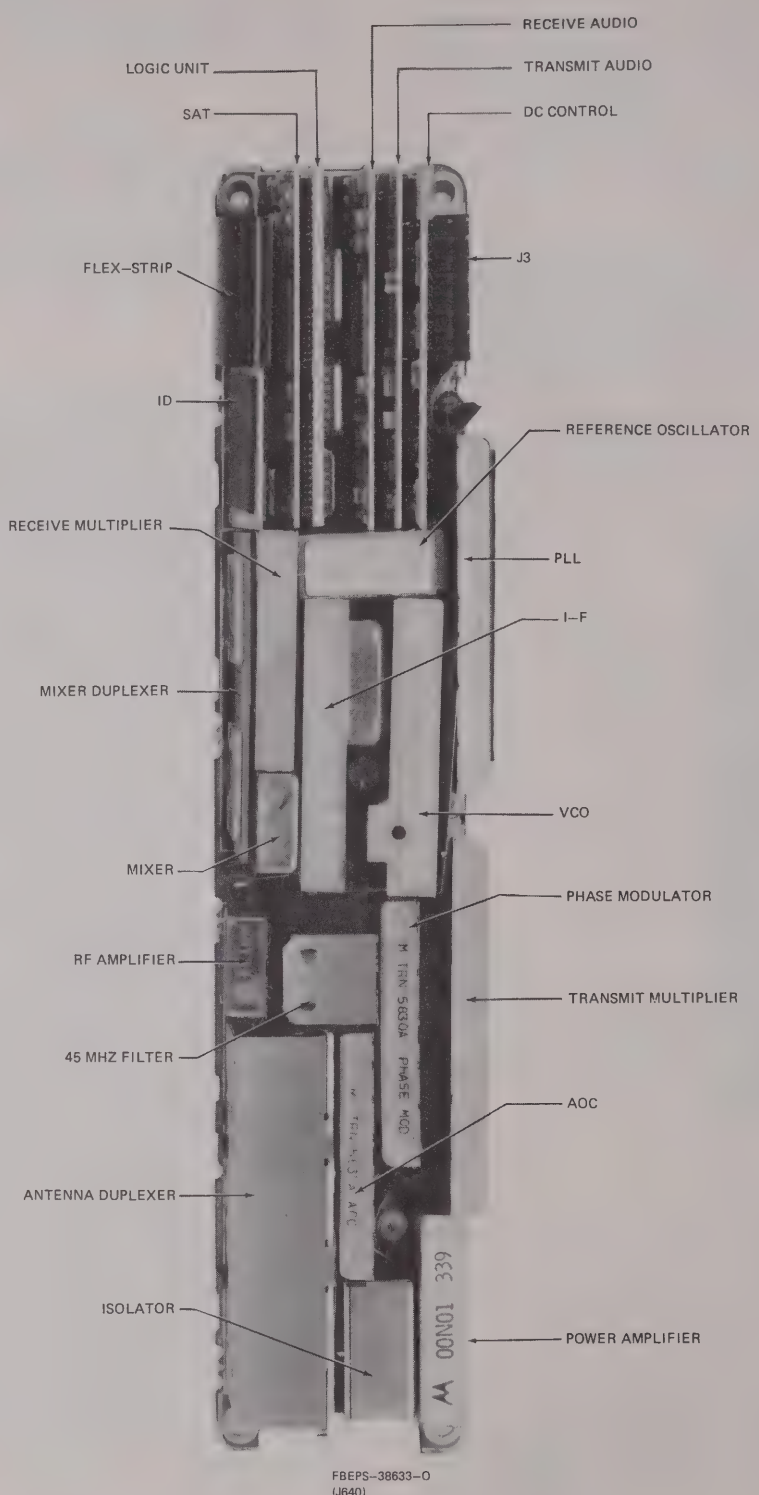


Figure 3. Location of Modules on Interconnect Board

Table 2A. Radio Does Not Turn On

	Test Command Entry	Procedure	Normal Indication	If Indication is Normal	If Indication is Abnormal
a)	—	Remove battery and connect 7.5 V directly to center housing contacts. Measure dc voltage at pin 3 of J202 block.	7.5 V ±0.2 V	Proceed to b.	Replace interconnect board fuse (F1) if defective. Otherwise check keypad and keyboard or dc control module.
b)	—	Press and hold the **Pwr** key and measure the dc voltage at pin 3 of J202 block.	0.0 V +0.1 V	Proceed to c.	Check keypad and keyboard for contamination and/or replace keyboard.
c)	—	Press **Pwr** button several times and measure dc voltages at pins 2, 17 and 20 of dc control module.	5.0 V ±0.2 V	Proceed to d.	Replace dc control module.
d)	—	With 5 V supplies active, measure waveform at pin 20 of logic unit.	3.84 MHz ±2.5 ppm 0-5 V swing	Proceed to e.	Replace reference oscillator.
e)	—	Measure waveform at pin 6 of PLL module.	30 kHz ±10 Hz 0-5 V swing	Proceed to f.	Replace PLL module.
f)	—	While repeatedly pressing the **Pwr** button observe pins 13 and 14 of logic unit.	Bursts of 0-5 V data on pins 13 and 14	Check keyboard connector for continuity.	Check flex-strip for continuity and replace if necessary and/or replace logic unit.

Table 2B. Radio Does Not Turn Off

	Test Command Entry	Procedure	Normal Indication	If Indication is Normal	If Indication is Abnormal
a)	—	Remove battery and connect 7.5 V directly to center housing. Press and hold the **Pwr** key several times and measure the voltage at pin 3 of connector J202.	0.0 V when key is depressed. 7.5 V when key is released.	Proceed to b.	Check interconnect board and dc control module for shorts from ON/OFF to GND or B+.
b)	—	Check voltage of STATUS line, pin 15 of Tx audio, while pressing and releasing the **Pwr** key.	level should toggle between 0 V and 5 V each time the **Pwr** key is pressed.	Proceed to c.	Proceed to f.
c)	—	Check voltage of OFF ENABLE, pin 1 of dc control module.	5.0 V ±0.2 V.	Replace dc control module.	Proceed to d.
d)	—	Check voltage of POI, pin 11 of dc control module.	5.0 V ±0.2 V.	Proceed to e.	Replace dc control module.
e)	—	Measure waveform at pin 20 of logic unit.	3.84 MHz ±2.5 ppm 0-5 V swing.	Replace logic unit.	Replace reference oscillator.
f)	—	Check voltage of AUTO OFF, pin 12 of dc control module.	0.0 V +0.1 V.	Replace dc control module.	Proceed to d.

Table 3. Radio Turns On and Places a Number in Right-Hand Side of Display

	Test Command Entry	Procedure	Normal Indication	If Indication is Normal	If Indication is Abnormal
a)	—	If number is 1, 2, 3, 4, 5, or 9 replace logic unit.	—	—	—
b)	—	If number is 6, reprogram NAM.	—	—	—
c)	—	If number is 7 or 8, faulty ID module.	—	—	—
d)	—	If number is a 10, troubleshoot 'synthesizer lock'.	—	—	—
e)	—	If number is an 11, it indicates that the 3-wire bus RTN line is shorted to 0 V. Remove each module connected to the RTN line until the power up sequence is successful. Check for foreign material on flex circuit and back of interconnect board.	—	—	—
f)	—	If number is a 12, it indicates an RSSI problem. Troubleshoot from Table 6 starting at step c.	—	—	—
g)	—	If number is A13, it indicates a false transmitter on condition. Replace the AOC module and/or troubleshoot the transmit line up.	—	—	—

Table 4. Keypad Provides Feedback but No Digits are Placed in The Display

Test Command Entry		Procedure	Normal Indication	If Indication is Normal	If Indication is Abnormal
a)	—	Unlock the unit using the 3-digit lock code or use the 6-digit security code as defined in the Operating Instructions section.	Feedback and displayed digits after key depressions.	Done.	Proceed to b.
b)	—	Place unit in service level 4 using the 6-digit security code as defined in the Operating Instructions section.	Feedback and displayed digits after key depressions.	Done.	Replace keyboard circuit board.

Table 5. Keypad Produces Digits, but No Feedback

Test Command Entry		Procedure	Normal Indication	If Indication is Normal	If Indication is Abnormal
a)	—	Enable Feedback by entering the sequence **Fcn-2-Clr** on the portable keypad.	Feedback and displayed digits after key depressions.	Done.	Troubleshoot audio tone path.

Table 6. No Ring Alert

Test Command Entry		Procedure	Normal Indication	If Indication is Normal	If Indication is Abnormal
a)	—	Push the **Fcn** key and then the **Vol** key to produce the ring alert. Measure the ac voltage on Rx audio module pin 9 (ALERT XDUCER).	2 to 4 V peak-to-peak depending on the volume; hi or low.	Proceed to c.	Proceed to b.
b)	—	Produce the ring alert as in a. Measure the ac voltage on Rx audio module pin 7 (ALERT TONE).	5 V peak-to-peak.	Replace the Rx audio module, TRN5823A.	Replace the logic unit module TRN5808A.
c)	—	Produce the ring alert as in a. Measure the ac voltage at pin 2 of J3 (ALERT XDUCER).	2 to 4 V peak-to-peak.	Proceed to d.	Debug connector J3/P3.
d)	—	Produce the ring alert in a. Measure the ac voltage on pins 3 and 4 of the alert connector. (J101/P101-B).	2 to 4 V peak-to-peak on pin 3 and approximately 0 V on pin 4.	Replace the alert transducer.	Replace the keyboard, TRN5807A.

Table 7. No Receive Audio and No Tones From The Portable Speaker

Test Command Entry		Procedure	Normal Indication	If Indication is Normal	If Indication is Abnormal
a)	*#, 4#, 330#	Unmute the Rx DTMF tones only. Cycle to max volume using the **Vol** key. Measure the ac voltage at pin 1 of the Rx audio module (EXT EAR).	Approximately 230 mV rms.	Proceed to c.	Proceed to b.
b)	—	With setup as in a, measure the ac voltage at Rx audio module pin 19 (Rx DTMF).	Approximately 5 V peak-to-peak.	Replace the Rx audio module, TRN5823A.	Replace the logic unit module, TRN5808A.
c)	—	With setup as in a, measure the ac voltage at Rx audio module pin 5 (SPKR).	Approximately 2 V rms.	Proceed to d.	Replace the Rx audio module, TRN5823A.
d)	—	With setup as in a, measure the ac voltage at pin 4 of J3 (SPKR).	Approximately 2 V rms.	If the speaker is now working debug J3/P3 connection. If not go to e and debug the speaker path.	Debug J3/P3 connection.
e)	—	With setup as in a, measure the ac voltage at P101-A, pins 1 and 2.	Approximately 2 V rms at pin 2 and approximately 0 V at pin 1.	Replace the speaker or its female connector. A good speaker will have a dc impedance of approximately 150 ohms.	Replace the keyboard, TRN5807A.

Table 8. No Receive Audio and No Tones Present at Pin 4 of J202 (EXTEAR)

Test Command Entry	Procedure	Normal Indication	If Indication is Normal	If Indication is Abnormal
a) *#, 4#, 330#	Unmute the Rx DTMF tones only. Cycle to max volume using the **Vol** key. Measure the voltage at pin 4 of J202 (EXT EAR).	Approximately 230 mV rms.	The problem may be intermittent.	Proceed to step b.
b) —	With setup as in a, measure the ac voltage at pin 1 of the Rx audio module (EXT EAR).	Approximately 230 mV rms.	Debug the EXT EAR path to J202.	Proceed to c.
c) —	With setup as in a, measure the ac voltage at Rx audio module pin 19 (Rx DTMF).	Approximately 5 V peak-to-peak.	Replace the Rx audio module, TRN5823A.	Replace the logic unit module, TRN5808A.

Table 9. No Tones but Receive Audio is Present

Test Command Entry	Procedure	Normal Indication	If Indication is Normal	If Indication is Abnormal
*#, 4#, 330#	Unmute the Rx DTMF tones only. Measure the ac voltage at Rx audio module pin 19 (Rx DTMF).	Approximately 5 V peak-to-peak	Replace the Rx audio module, TRN5823A.	Replace the logic unit module, TRN5808A.

Table 10. No (or Distorted) Receive Audio but Tones are Present

Test Command Entry	Procedure	Normal Indication	If Indication is Normal	If Indication is Abnormal
*#, 4#, 11333#, 8#, 39#	Unmute Rx audio. Set to conversation and cycle to maximum volume with **Vol** key. Input channel 333 signal (−50 dBm) at portable antenna FM modulated with 1 kHz at 8 kHz deviation.	—	—	—
	Measure ac voltage at pin 18 of Rx audio module (DISCR). Also measure distortion.	Approximately 150 mV rms. Distortion less than 5%. Channel 333 = 879.99 MHz.	Replace Rx audio module, TRN5823A.	Replace i-f module, TRN5831A.

Table 11. Radio Cannot Get Service On Test System

Test Command Entry	Procedure	Normal Indication	If Indication is Normal	If Indication is Abnormal
a) —	Verify that registration status is in the 'Normal' mode. Press **Rcl***.	Display = 1.	Proceed to b.	Repeatedly press '*' until a '1' appears in the display, then press **Sto**.
b) —	Using the R-2008C analyzer, check CHANA and CHANB contents of NAM by reading out the ID module contents. (See paragraph 5 of this section.)	Test system channel invalid range as indicated by CHANA, CHANB and NDED.	Proceed to c.	Change test system channel number or reprogram NAM.
c) *#,11333#	Set up test system with signaling channel data (overhead and filler words) on channel 333. Apply this signal at low power (approximately −70 dBm) to the portable antenna. Execute command **22#** (control channel message count). The display should increase at about 20 counts per second. Terminate command by pressing # key twice.	20 counts per second. Channel 333 = 879.99 MHz	Proceed to d.	If display = 00000 troubleshoot receiver sensitivity.
d) 35#	Take an RSSI measurement of the −70 dBm input using the **35#** command. Display should immediately show the RSSI count.	Count greater than or equal to 100.	Replace logic unit module, TRN5808A.	Proceed to e.
e) —	Measure signal at pin 13 of SAT module.	0-5 V square wave (52 kHz ±4 kHz).	Proceed to f.	Replace SAT module, TRN5826A.
f) —	Measure voltage at pin 7 of I-F module.	V dc greater than 1.0 V.	Replace logic unit model, TRN5808A.	Troubleshoot receiver (Table 12).

Table 12. Receiver Produces Noise but Does Not Quiet, or Has Poor Sensitivity

Test Command Entry	Procedure	Normal Indication	If Indication is Normal	If Indication is Abnormal
a) *#, 11333#, 8#	Input channel 333 signal (−100 dBm) at portable antenna, FM modulated with 1 kHz at ±8 kHz deviation. Measure audio level at pin 5 of i-f module.	Level of 1 kHz tone should be 149 mV rms ±10%. Channel 333 = 879.99 MHz.	Replace Rx audio module, TRN5823A.	Proceed to b.
b) —	Change input signal level to −50 dB, no modulation. Measure the signal level on pin 17 of antenna duplexer module using 1000 ohms (20:1) resistive probe, and the spectrum analyzer in the R-2008C analyzer. Record this level.	Level should be −50 dBm ±3 dB.	Proceed to c.	Examine coax and rf switch (J201) and replace defective part.
c) —	Measure the rf level at pin 1 of rf amplifier module and record level.	Level should be no more than 3 dB less than the level in b.	Proceed to d.	Replace antenna duplexer module, TRN5837A.
d) —	Measure the rf level at pin 17 of mixer duplexer module and record level.	Level should be at least 8 dB greater than the level in c.	Proceed to f.	Proceed to e.
e) —	Measure the dc voltage at pin 5 of rf amplifier module.	Voltage should = 5.0 ± 0.15 volts.	Replace rf amplifier module TRN5832A.	Troubleshoot dc control module.
f) —	Measure the rf level at pin 1 of mixer module and record level.	Level should be no more than 4 dB less than the level in d at 879.99 MHz.	Proceed to g.	Replace mixer duplexer module, TRN5840A.
g) —	Measure the 45 MHz rf level at pin 4 of 45 MHz filter module record level.	Level should be at least 10 dB greater than the level in f.	Proceed to i.	Proceed to h.
h) —	Measure the dc voltage at pin 5 of mixer module.	DC voltage should be 5.0 ±0.15 volts.	Proceed to j.	Troubleshoot dc control module.
i) —	Measure the rf level at pin 1 of i-f module.	Level should be no more than 4 dB less than level in f at 45.0 MHz.	Replace i-f module, TRN5831A.	Replace 45 MHz filter module, TFN6048A.
j) —	Measure the rf level at pin 11 of VCO module.	Level should be −8 dBm ±3 dB at 69.5833 MHz.	Proceed to k.	Replace VCO module.
k) —	Measure the rf level at pin 1 of Rx multiplier module and record level.	Level should be −11 dBm ±3 dB.	Replace i-f module, TRN5831A.	Proceed to l.
l) —	Measure dc voltage on pin 5 of Rx multiplier module. The radio B+ should be 7.5 V.	Voltage should be 7.0 V to 7.5 V.	Replace TRN5829A.	Troubleshoot dc control module.

Table 13. Low or No RSSI Readings

Test Command Entry	Procedure	Normal Indication	If Indication is Normal	If Indication is Abnormal
a) —	Go through procedure of Table 12.	—	—	—
b) —	Input unmodulated signal of amplitude −102 dBm and read RSSI voltage on pin 7 of i-f module.	DC voltage should be greater than 95 mV.	Go to Table 11.	Replace i-f module, TRN5831A.

Table 14. Radio Will Not Complete Call and/or Lacks Modulation by One or More of The Following: Tx SAT, Tx DATA, Tx DTMF, Internal Mic or EXT MIC (Sidetone may also be a Problem)

Test Command Entry	Procedure	Normal Indication	If Indication is Normal	If Indication is Abnormal
a) *#, 11333#, 122#, 5#, 25#	Determine if Tx SAT produces modulation. Transmit on channel 333. Unmute the Tx SAT only. Measure Tx SAT deviation.	Tx SAT deviation approximately ±2 kHz residual.	Note result. Proceed to b.	Note result. Proceed to b.
b) 26#, 14#, 5#	Determine if Tx DATA produces modulation. Unmute the Tx DATA only. Measure Tx DATA deviation.	Tx DATA deviation approximately ±8 kHz + residual.	If Tx DATA was normal but Tx SAT was not, go to Table 19 and debug Tx SAT. If both were normal proceed to c.	If Tx DATA was abnormal but Tx SAT was normal, go to Table 20 and debug Tx DATA. If both were abnormal proceed to c.

Table 14. Radio Will Not Complete Call and/or Lacks Modulation by One or More of The Following: Tx SAT, Tx DATA, Tx DTMF, Internal Mic or EXT MIC (Sidetone may also be a Problem (Cont'd.)

Test Command Entry	Procedure	Normal Indication	If Indication is Normal	If Indication is Abnormal
c) 15#, 330#	Determine if Tx DTMF produces modulation. Unmute one pair of Tx DTMF tones (key 0). Measure Tx DTMF deviation.	Tx DTMF deviation for tones is approximately ±10.3 kHz + residual.	If Tx DTMF is normal but both Tx SAT and Tx DATA were abnormal go to Tables 19 and 20 and debug Tx SAT and Tx DATA. If all three are normal proceed to d.	If Tx DTMF is abnormal but both Tx SAT and Tx DATA were normal, go to Table 21 and debug Tx DTMF. If all three are abnormal go to Table 16.
d) 34#, 10#, 39#	Determine if internal MIC produces modulation. Unmute Tx audio only. Measure Tx audio deviation when whistling hard into microphone.	Tx audio deviation approximately ±11 kHz + residual.	Note result. Proceed to e.	Note result. Proceed to e.
e) —	Determine if EXT MIC produces modulation. Use the setup as in d. Apply 8.7 mV rms @ 1000 Hz riding on 3.5 V dc bias to EXT MIC pin 5 of J202. Measure Tx audio deviation.	Tx audio deviation approximately ±2.9 kHz + residual.	If EXT MIC is normal but internal MIC is abnormal, go to Table 18 and debug internal MIC path. If both are normal, the microphone paths are ok. The internal microphone may be distorting.	If EXT MIC is abnormal but internal MIC is normal, debug the EXT MIC path from connector J202. If both are abnormal go to Table 17 and debug Tx audio path.

Table 15. No (Low) Power Out

Test Command Entry	Procedure	Normal Indication	If Indication is Normal	If Indication is Abnormal
a) *#,5#, 11333#	Measure dc voltage at pin 6 of the power amplifier.	6.0 V ±1.0 V	Troubleshoot: 1. isolator module 2. antenna duplexer module 3. coax and rf switch (J201)	Proceed with step b.
b) —	Measure dc voltage on pin 2 of power amplifier module. The radio B+ should be 7.5 V.	7.2 V ±0.3	Proceed to c.	Proceed to i (see 1 below).
c) —	Measure dc voltage on pin 3 of power amplifier module.	4.2 V ±2 V	Proceed to d.	Proceed to j (see 2 below).
d) —	Measure dc voltage on pin 5 of power amplifier module.	7.5 V ±0.3	Proceed to e.	Check B+ path between battery and power amplifier module.
e) —	Measure rf power at pin 1 of power amplifier module.	1.4 V rms	Replace power amplifier module, TLF6591A.	Proceed to f.
f) —	Measure rf power at pin 1 of Tx multiplier module.	280 mV rms	Replace Tx multiplier module.	Proceed to g.
g) —	Measure rf power at pin 14 of the phase modulator module.	18 mV rms	Proceed to h.	Replace VCO module, TRN5827A.
h) —	Measure dc voltage at pin 11 of phase modulator module.	4.9 V ±0.5 V	Replace phase modulator module, TRN5830A.	Proceed to i (see 3 below).
i) —	Measure dc voltage at pin 6 of AOC module.	0.7 V ±0.3 V	Replace AOC module, TRN5835A.	Replace Tx audio module, TRN5824A.
j) —	Measure dc voltage at pin 1 of AOC module.	7.0 to 7.5 V	Replace AOC module, TRN5835A.	Troubleshoot SW B+ path.

1. Low reading may be due to faulted power amplifier or Tx multiplier modules. Verify by removing these modules, one at a time, and measure voltage at pin 2 of power amplifier location. Return of normal reading identifies removed module as being defective.

2. Low reading may be due to faulted power amplifier module. Verify by removing this module and measure voltage at pin 3 of module location. If this reading is normal (greater than 7.0 V dc), replace power amplifier module.

3. Low reading may be due to faulted phase modulator or Tx multiplier modules. Verify by removing these modules, one at a time, and measure voltage at pin 11 of phase modulator location. Return of normal reading identifies removed module as being defective.

Table 16. No Transmit Modulation of Any Kind

Test Command Entry	Procedure	Normal Indication	If Indication is Normal	If Indication is Abnormal
a) *#,11333#, 122#, 5#, 14#	Transmit on channel 333. Unmute Tx DATA (10 kHz) only. Measure Tx DATA waveform on Tx audio module output pin 4.	Approximately 150 mV peak-to-peak.	Proceed to b to debug deviation adjust control (R3).	Proceed to c.
b) —	Unmute Tx DATA only, as in a. Measure Tx DATA waveform at phase modulator input pin 9.	Approximately 90 mV peak-to-peak.	Replace phase modulator module, TRN5830A. Repeat Table 14 with the radio disassembled.	Replace and/or readjust deviation adjust control (R3). See alignment procedure.
c) —	Unmute Tx DATA only as in a. Measure Tx DATA waveform at Tx audio module pin 3.	Approximately 1200 mV peak-to-peak.	Proceed to d to check enable signal to the Tx audio module.	Proceed to Table 20.
d) —	Unmute Tx DATA only, as in Table 14-a. Measure RADIO ENABLE at Tx audio module, pin 8.	Approximately 5 V dc.	Replace Tx audio module, TRN5824A.	Replace logic unit module, TRN5808A.

Table 17. Both Internal MIC and EXT MIC from J202 Do Not Produce Modulation but Tx SAT, Tx DATA and Tx DTMF Modulation are Produced

Test Command Entry	Procedure	Normal Indication	If Indication is Normal	If Indication is Abnormal
a) *#, 10#, 39#	Apply 8.7 mV rms 1000 Hz signal riding on 3.5 V dc to J202, pin 5 (EXT MIC). Enable the Tx audio. Measure the ac voltage at Tx audio module pin 20.	Approximately 8 mV rms.	Replace Tx audio module TRN5824A.	Proceed to b to determine if the keyboard is shunting away the signal.
b) —	Disconnect the keyboard from the motherboard so that the connector J3 is floating. With the input as in Table 15-a, measure the ac voltage at Tx audio module pin 20.	Approximately 8 mV rms.	Replace the keyboard, TRN5807A.	Debug the EXT MIC path on flex-strip.

Table 18. Internal MIC Does Not Produce Modulation but EXT MIC from J202 Does Produce Modulation

Test Command Entry	Procedure	Normal Indication	If Indication is Normal	If Indication is Normal
a) *#, 10#, 39#	Unmute the Tx audio. Whistle loudly into the internal microphone. Measure the ac voltage at Tx audio module pin 20.	Several hundred mV peak-to-peak.	Note result. Proceed to b.	Proceed to c.
b) —	Whistle into the internal microphone as in a. Measure the ac voltage at the Tx audio module pin 4.	Several hundred mV peak-to-peak.	The internal MIC path and Tx audio are ok. The problem may be intermittent. Proceed to c.	Replace the Tx audio module, TRN5824A.
c) —	Whistle into the internal microphone as in a. Measure the ac voltage at connector P3, pin 6.	Several hundred mV peak-to-peak.	Debug keyboard connector P3.	Proceed to d to determine if the internal microphone is getting bias.
d) —	Measure the dc microphone bias voltage (Vref) on connector P3, pin 8.	2.9 to 3.3 V dc.	Proceed to e to look for a good microphone ground.	Proceed to g to debug Vref path.
e) —	Measure the dc voltage on connector P3, pin 5.	Ground potential.	Proceed to f to look for the correct keyboard output dc voltage.	Debug connector P3.
f) —	Measure the dc voltage on connector P3, pin 6.	Approximately 1 V dc.	Debug connectors J102/P102 microphone. When connector pin 3 is approximately 3.2 V dc and pin 1 is ground, the microphone output pin 2 should be approximately 0.6 V dc.	Replace keyboard, TRN5807A.
g) —	Measure the dc voltage on Vref, Tx audio module pin 11.	2.9 to 3.3 V dc.	Debug connector J3/P3.	Replace Tx audio module, TRN5824A.

Table 19. Tx SAT Produces No Modulation

Test Command Entry	Procedure	Normal Indication	If Indication is Normal	If Indication is Abnormal
a) *#, 25#, 11333#	Unmute the Tx SAT only. Measure voltage at Tx audio module pin 1.	Tx SAT at approximately 600 mV peak-to-peak.	Replace Tx audio module, TRN5824A.	Proceed to b.
b) —	Measure the dc voltage (SW B+) on SAT module pins 9 and 18. The radio B+ should be 7.5 V.	7.0 to 7.5 V	Proceed to c.	Debug the SW B+ supply from the dc control module. SW B+ should be 7.0-7.5 V whenever the radio is on.
c) —	Measure the dc voltage on SAT module pin 17.	Ground, approximately 0 V dc.	Replace SAT module, TRN5826A.	Replace Rx audio module, TRN5823A.

Table 20. Tx DATA Produces No Modulation

Test Command Entry	Procedure	Normal Indication	If Indication is Normal	If Indication is Abnormal
a) *#, 14#, 11333#	Unmute the Tx DATA only. Measure voltage at Tx audio module pin 3.	Tx DATA at approximately 1200 mV peak-to-peak.	Replace Tx audio module, TRN5824A.	Proceed to b.
b) —	Measure dc voltage SW B+ on SAT module pins 9 and 18. The radio B+ should be 7.5 V.	7.0 to 7.5 V	Proceed to c.	Debug the SW B+ supply from the dc control module. SW B+ should be 7.0-7.5 V whenever the radio is on.
c) —	Measure the Tx DATA waveform at SAT module pin 5.	Approximately 0-5 V peak-to-peak.	Proceed to d.	Replace the logic unit module TRN5808A.
d) —	Measure the dc voltage at $\overline{\text{MANCHGATE}}$, at SAT module pin 6.	Ground, approximately 0 V dc.	Replace the SAT module, TRN5826A.	Replace the logic unit module, TRN5808A.

Table 21. Tx DTMF Produces No Modulation

Test Command Entry	Procedure	Normal Indication	If Indication is Normal	If Indication is Abnormal
a) *#, 330#, 11333#	Unmute Tx DTMF with key 0 only. Measure voltage on Tx audio module pin 2.	Tx DTMF at approximately 2.4 V peak-to-peak.	Replace Tx audio module, TRN5824A.	Proceed to b to debug the Rx DTMF path.
b) —	Measure voltage on Rx audio module pin 19.	Rx DTMF at approximately 5 V peak-to-peak.	Replace the Rx audio module, TRN5823A.	Replace the logic unit module, TRN5808A.

Table 22. No Sidetone

Test Command Entry	Procedure	Normal Indication	If Indication is Normal	If Indication is Abnormal
a) *#, 10#, 39#	Unmute the Tx audio and mute the Rx audio. Apply 8.7 mV rms 1000 Hz signal riding on 3.5 V dc bias to J202 pin 5 (EXT MIC). Measure the ac voltage at Tx audio module pin 7.	Sidetone at 30-45 mV rms.	Proceed to b.	Replace Tx audio module, TRN5824A.
b) —	With the same conditions as in a, measure the ac voltage at Rx audio pin 5.	SPKR at 30-45 mV rms.	Sidetone may be intermittent.	Replace Rx audio module, TRN5823A.

4. ALIGNMENT PROCEDURE

Whenever a module on the interconnect board is replaced, the circuitry must be re-aligned to ensure compliance with published specifications. This procedure (found in Table 23) should only be attempted when the unit is connected to a stable 7.5 V dc supply and the R-2008 Analyzer.

5. ADDITIONAL SERVICING INFORMATION

5.1 START-UP SEQUENCE

Upon applying power to the radio, the logic unit performs a diagnostic routine to check 13 internal functions. If an error occurs, an error code appears in the display which identifies the defective components. These codes are listed in Table 24.

5.2 NUMBER ASSIGNMENT MODULE (NAM)

The NAM is part of the ID module and contains the subscriber's assigned telephone number as well as other information required in the operation of the portable telephone. Table 25 lists the contents of the NAM. An R-1801A Digital Analyzer Controller with the appropriate reader/programmer module is required to read the contents of the NAM.

Table 23. Alignment Procedure

Parameter	Test Command Entry	Control	Specification
Output Power	*#, 11333#, 122#, 5#	R4	29.0 dBm; ±0.1 dB
Transmit Frequency	*#, 11333#, 122#, 5#	Reference Oscillator Adjustment Screw	834.990 MHz; ±210 Hz
Deviation	Prerequisite: Inject 2.5 kHz tone (54 mV rms on 3.5 V dc) at either pin 5 or 6 of connector J202.		
	*#, 11333#, 127#, 5#, 38#	R3	10.5 kHz; ±100 Hz

Table 24. Power-Up Self-Diagnostics

Error Code*	Error Description	Modules(s) Affected
1	Page 0 ROM Checksum	Logic Unit
2	Page 1 ROM Checksum	Logic Unit
3	Microprocessor Internal RAM	Logic Unit
4	RAM (bits 0-3)	Logic Unit
5	RAM (bits 4-7)	Logic Unit
6	NAM Checksum	ID Module
7	SNM Checksum	ID Module
8	SNM Encoding Error	ID Module
9	Data Interface	Logic Unit
10	Synthesizer Lock	PLL/VCO
11	3-Wire Bus Return Line = 0	Logic Unit/J202
12	RSSI	SAT/IF
13	Transmitter Power Detector	AOC/Power Amp

*Appears in the right-most digit location of the display.

Table 25. NAM Contents

Address (Hexadecimal)	Contents
00	Bits 0-6 of this byte hold bits 8-14 of home system ID (SIDH). Bit 7 is zero.
01	This byte holds bits 0-7 of SIDH.
02	NAM state byte (NAMSTE): Bit — Definitions 0 MIN mark 1 Hands-Free 2 Horn alert 3 Repertory dialing 4 Undefined 5 End-to-end signaling (DTMF) 6 Preferred system 7 Local use
03	Bits 0-5 of this byte hold bits 4-9 of mobile ID number 2 (MIN2); area code. Bits 6 and 7 are zero.

Table 25. NAM Contents (Cont'd.)

Address (Hexadecimal)	Contents
04	Bits 4-7 of this byte hold bits 0-3 of MIN2. Bits 0-3 are zero.
05	Bits 4-7 of this byte hold the station class mark (SCM); contains 06 hexadecimal for portable. Bits 0-3 hold bits 20-23 of mobile ID number 1 (MIN1); phone number.
06	This byte holds bits 12-19 of MIN1.
07	This byte holds bits 4-11 of MIN1.
08	Bits 4-7 of this byte hold bits 0-3 of MIN1. Bits 0-3 are zero.
09	Bits 0-2 of this byte hold bits 8-10 of initial home paging channel (IPCH). Bits 3-7 are zero.
0A	This byte holds bits 0-7 of IPCH.

Table 25. NAM Contents (Cont'd.)

Address (Hexadecimal)	Contents
0B	Bits 0-3 of this byte hold the access overload class (ACCOLC). Bits 4-7 are zero.
0C	Bits 0-3 of this byte holds the group ID mark (GIM). Bits 4-7 are zero.
0D	This byte holds the BCD value of digits 1 and 2 of the 6-digit security code. Each value consists of 4-bits.
0E	This byte holds the BCD value of digits 3 and 4 of the 6-digit security code. Each value consists of 4-bits.
0F	This byte holds the BCD value of digits 5 and 6 of the 6-digit security code. Each value consists of 4-bits.
10	This byte holds the BCD value of digits 1 and 2 of the mobile ID number (MIN; area code plus phone number). Each value consists of 4-bits.
11	This byte holds the BCD value of digits 3 and 4 of MIN. Each value consists of 4-bits.
12	This byte holds the BCD value of digits 5 and 6 of MIN. Each value consists of 4-bits.
13	This byte holds the BCD value of digits 7 and 8 of MIN. Each value consists of 4-bits.
14	This byte holds the BCD value of digits 9 and 10 of MIN. Each value consists of 4-bits.
15	Bits 0-2 of this byte holds bits 8-10 of system "A" starting control channel (CHANA; equals 333 for compatibility). Bits 3-7 are zero.
16	This byte holds bits 0-7 of CHANA.
17	Bits 0-2 of this byte holds bits 8-10 of system "B" starting control channel (CHANB; equals 334 for compatibility). Bits 3-7 are zero.
18	This byte holds bits 0-7 of CHANB.
19	This byte holds the number of dedicated control channels (NDED; 21 for compatibility).
1A-1C	Undefined.
1D	NAM options byte (NAMOPT): Bit — Definition 0 — Disable lock code 1 — Disable service levels 2 — Auto recall dialing 3 — Single system scan 4 — Expanded paging channels 5 — Keyboard test command disable 6 — Digit repertory: 0 = 16 digits, 1 = 24 digits 7 — Word sync scan + Tx delay enable
1E	Checksum adjust byte.
1F	Checksum byte.

5.3 HIGH RESIDUAL AM

This condition may occur due to one or both of the following possibilities:

(1) Defective phase modulator module or;

(2) Low drive to the phase modulator module (pin 14).

If the first condition is suspected, replace the phase modulator module. To determine if a low drive condition exists, measure the rf level at the input to the phase modulation. If low, replace the VCO module.

6. REFERENCE DIAGRAMS

Simplified Block Diagram DEPS-38161

Receiver Functional Block Diagram. EEPS-38135

Transmitter Functional Block Diagram EEPS-38176

DC Control Module Functional Block Diagram DEPS-38195

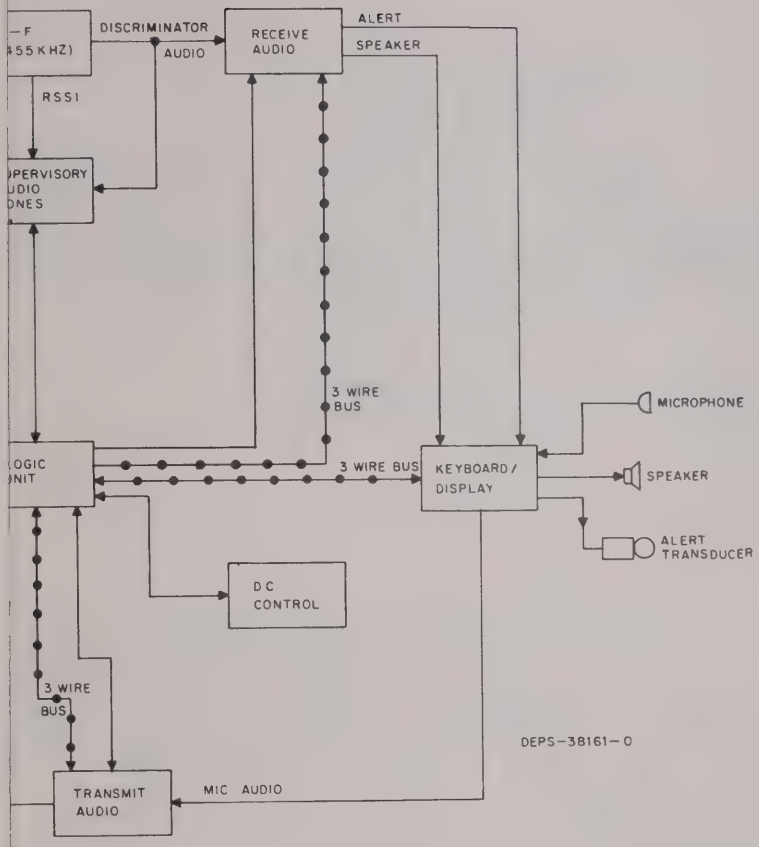
Synthesizer Functional Block Diagram DEPS-38194

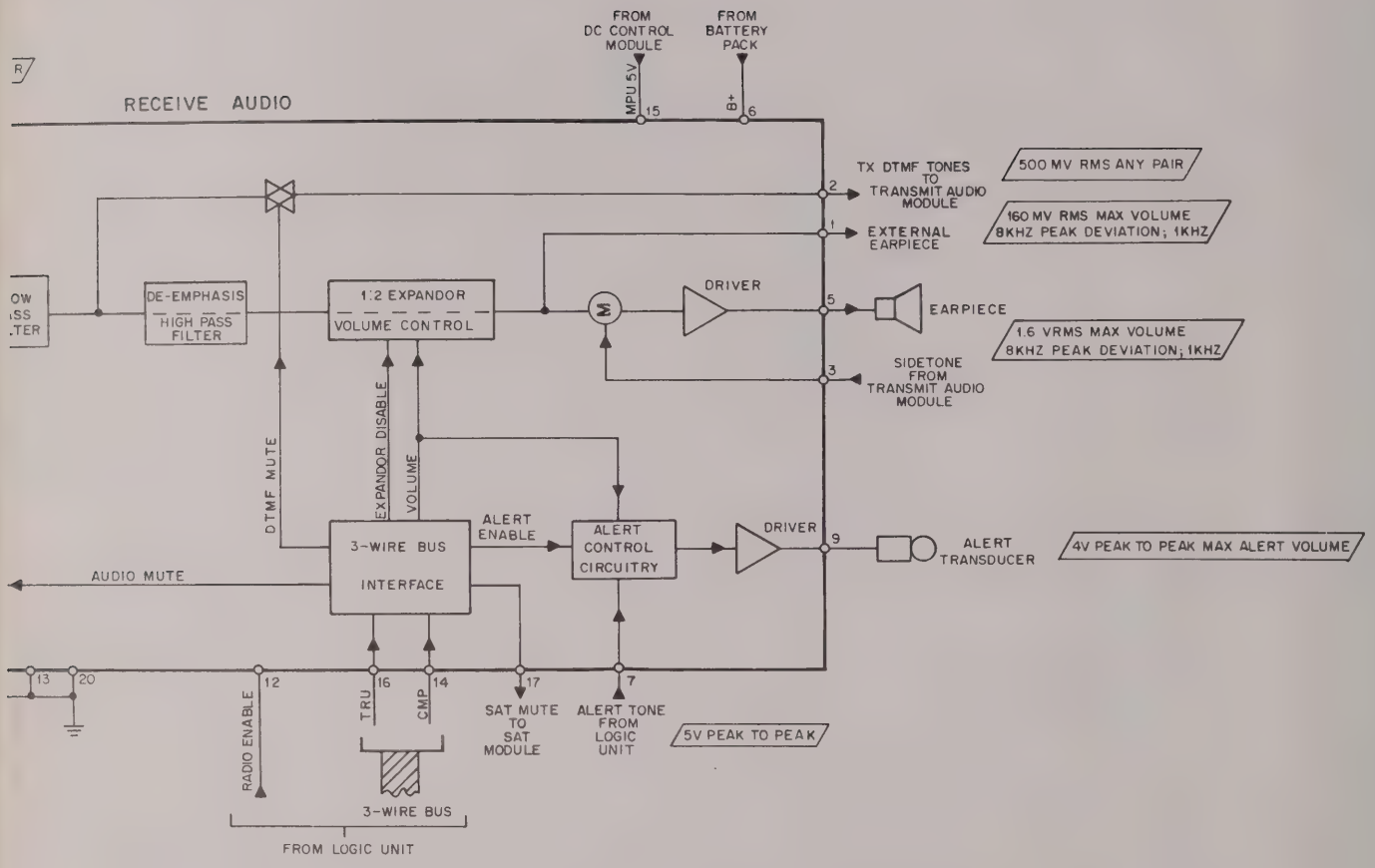
Logic Functional Block Diagram. DEPS-38401

Keyboard Functional Block Diagram CEPS-38261

Module-to-Signal/ Signal-to-Module Chart. EEPS-38123

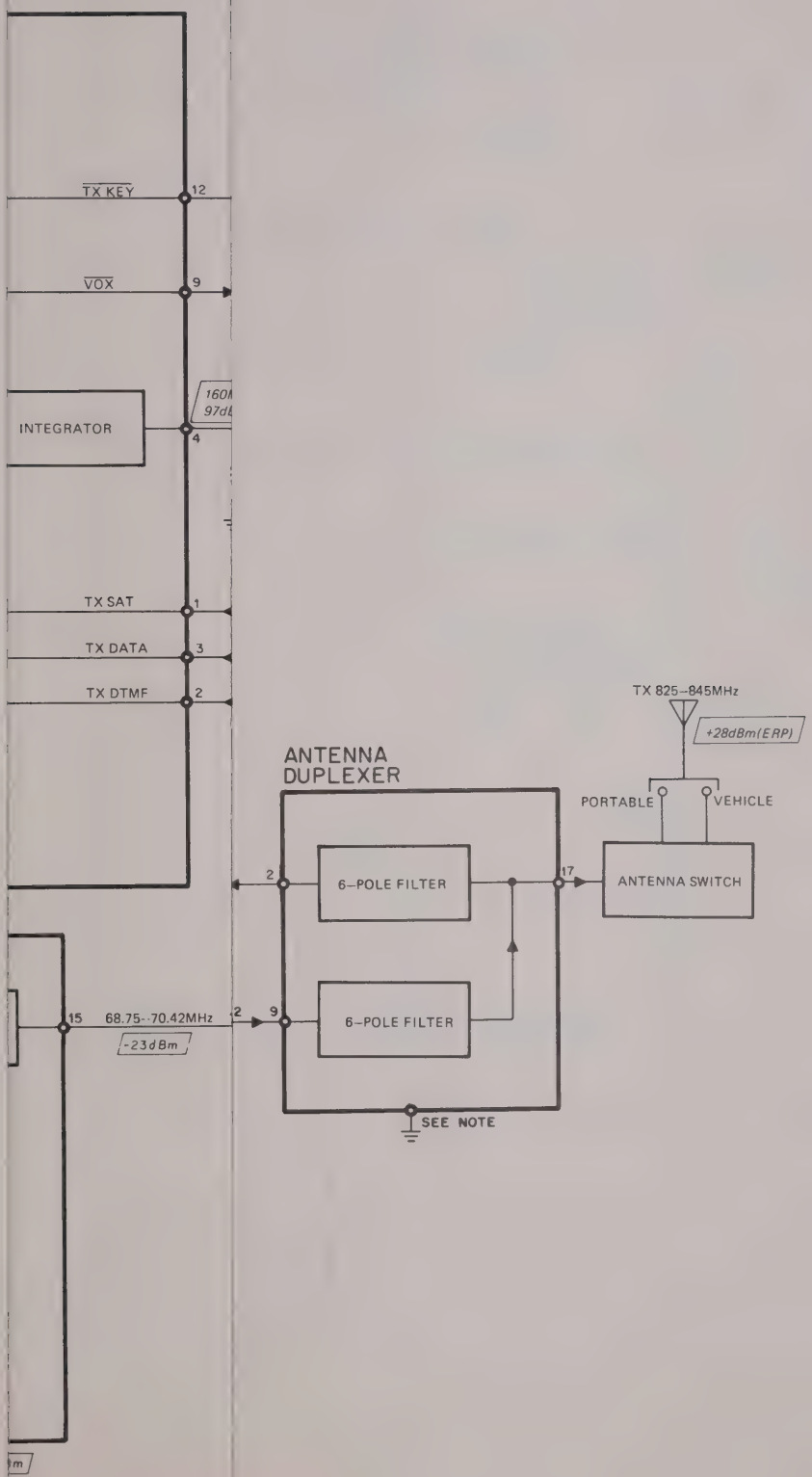
Portable Telephone Servicing Diagrams. PEPS-38640


DISCRIMINATOR
AUDIO
RECEIVE AUDIO
ALERT
SPEAKER
RSSI
3 WIRE BUS
MICROPHONE
3 WIRE BUS
KEYBOARD / DISPLAY
SPEAKER
ALERT TRANSDUCER
DC CONTROL
3 WIRE BUS
DEPS-38161-O
TRANSMIT AUDIO
MIC AUDIO



EEPS-38135-O

R IS A 20-PIN MODULE.
ND 17 ARE CONNECTED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12
VOX
9
INTEGRATOR
4
TX SAT
1
TX DATA
3
TX DTMF
2
ANTENNA
DUPLEXER
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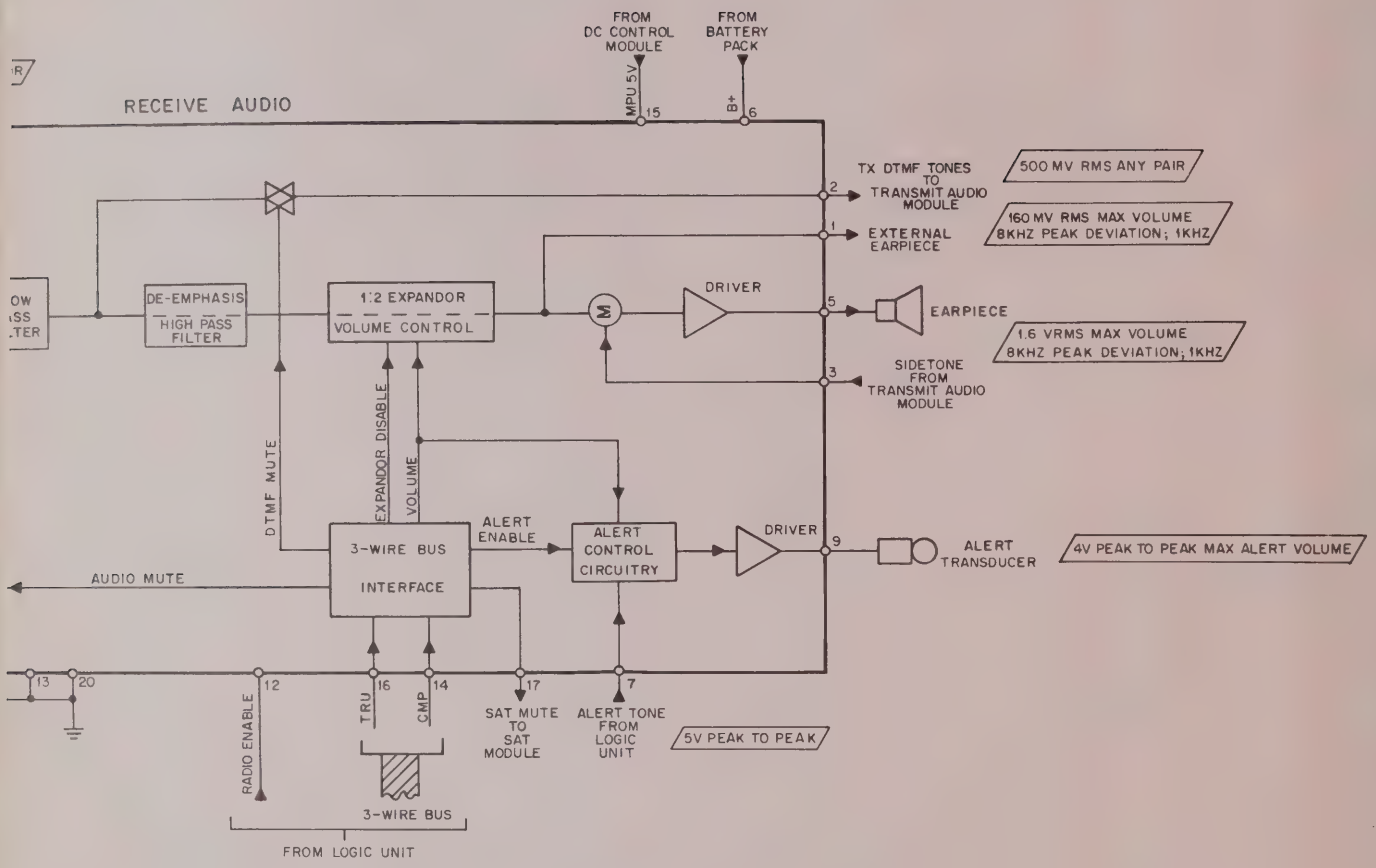
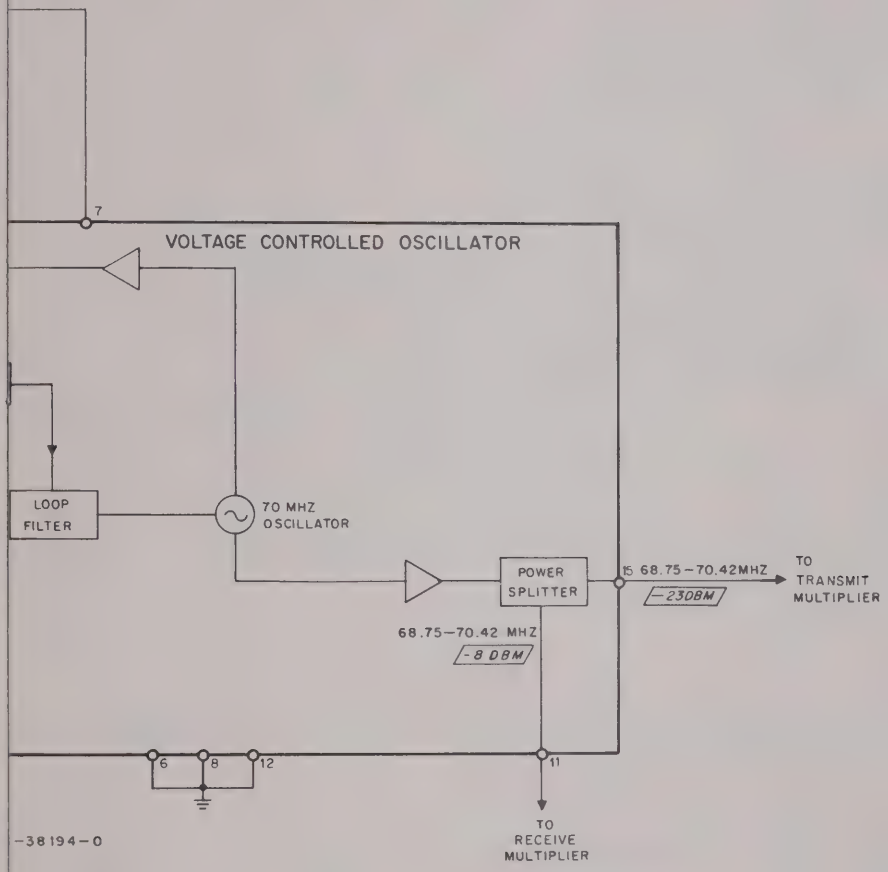
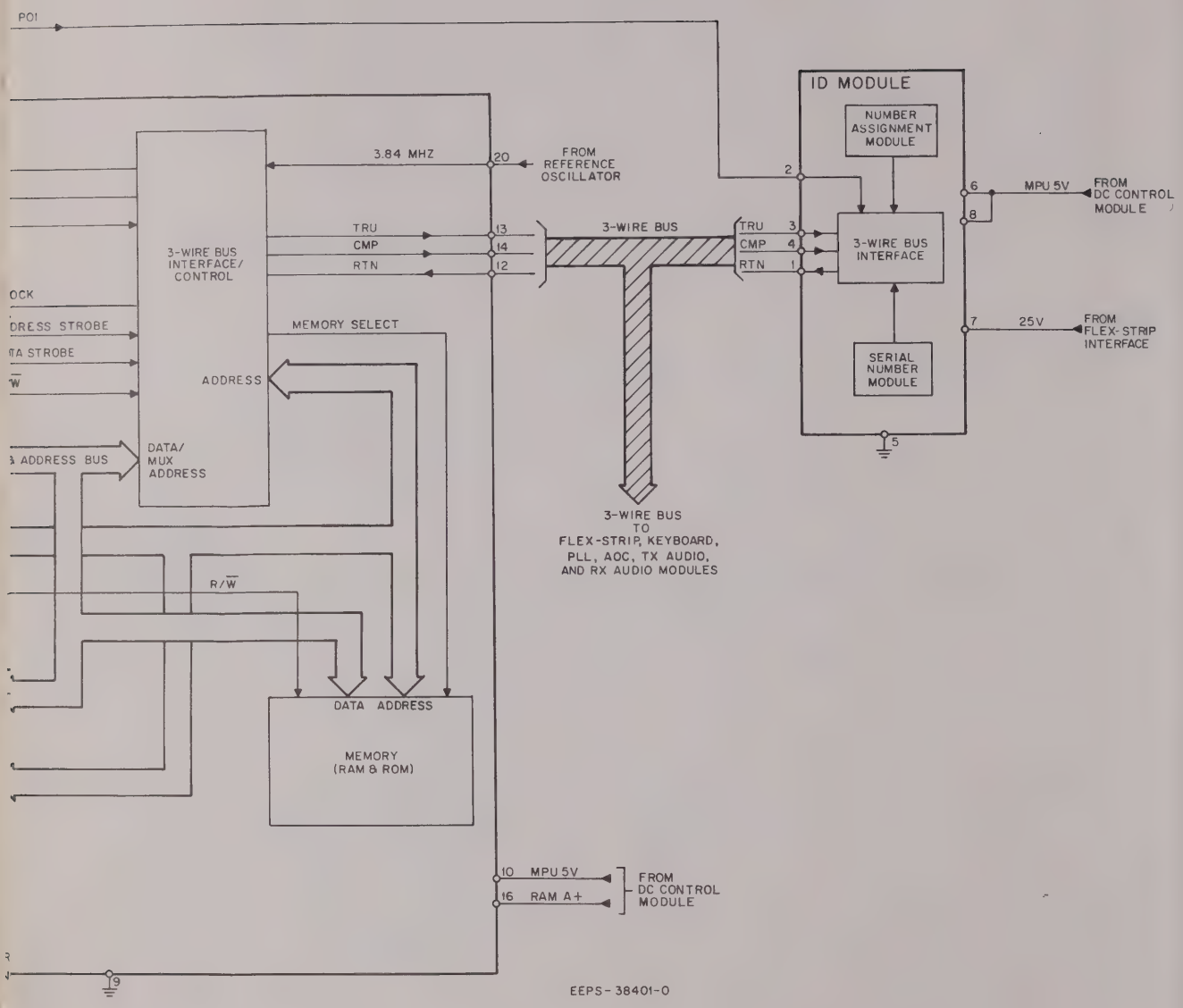
+28dBm(ERP)
PORTABLE
VEHICLE
2
6–POLE FILTER
17
ANTENNA SWITCH
15
68.75–70.42MHz
-23dBm
2
9
6–POLE FILTER
SEE NOTE



EEPS-38135-0

R IS A 20-PIN MODULE.
ND 17 ARE CONNECTED


7
VOLTAGE CONTROLLED OSCILLATOR
LOOP FILTER
70 MHZ OSCILLATOR
POWER SPLITTER
15 68.75–70.42MHZ
–23DBM
TO TRANSMIT MULTIPLIER
68.75–70.42 MHZ
–8 DBM
6
8
12
11
TO RECEIVE MULTIPLIER
–38194–O


POI
ID MODULE
NUMBER ASSIGNMENT MODULE
3.84 MHZ
20
FROM REFERENCE OSCILLATOR
2
6
MPU 5V
FROM DC CONTROL MODULE
8
3-WIRE BUS INTERFACE/ CONTROL
TRU
CMP
RTN
13
14
12
3-WIRE BUS
TRU 3
CMP 4
RTN 1
3-WIRE BUS INTERFACE
OCK
DRESS STROBE
TA STROBE
W
MEMORY SELECT
ADDRESS
7
25V
FROM FLEX-STRIP INTERFACE
SERIAL NUMBER MODULE
ADDRESS BUS
DATA/ MUX ADDRESS
5
3-WIRE BUS TO FLEX-STRIP, KEYBOARD, PLL, AOC, TX AUDIO, AND RX AUDIO MODULES
R/W
DATA ADDRESS
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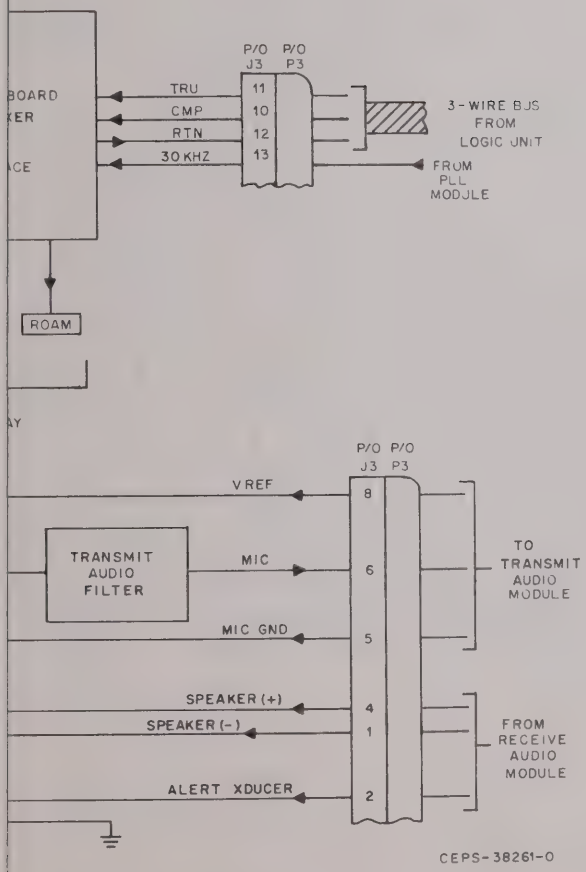
16 RAM A+
FROM DC CONTROL MODULE
9
EEPS-38401-0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P/O P3
TRU
CMP
RTN
30 KHZ
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10
12
13
3-WIRE BUS FROM LOGIC UNIT
FROM PLL MODULE
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VREF
TRANSMIT AUDIO FILTER
MIC
MIC GND
SPEAKER (+)
SPEAKER (-)
ALERT XDUCER
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4
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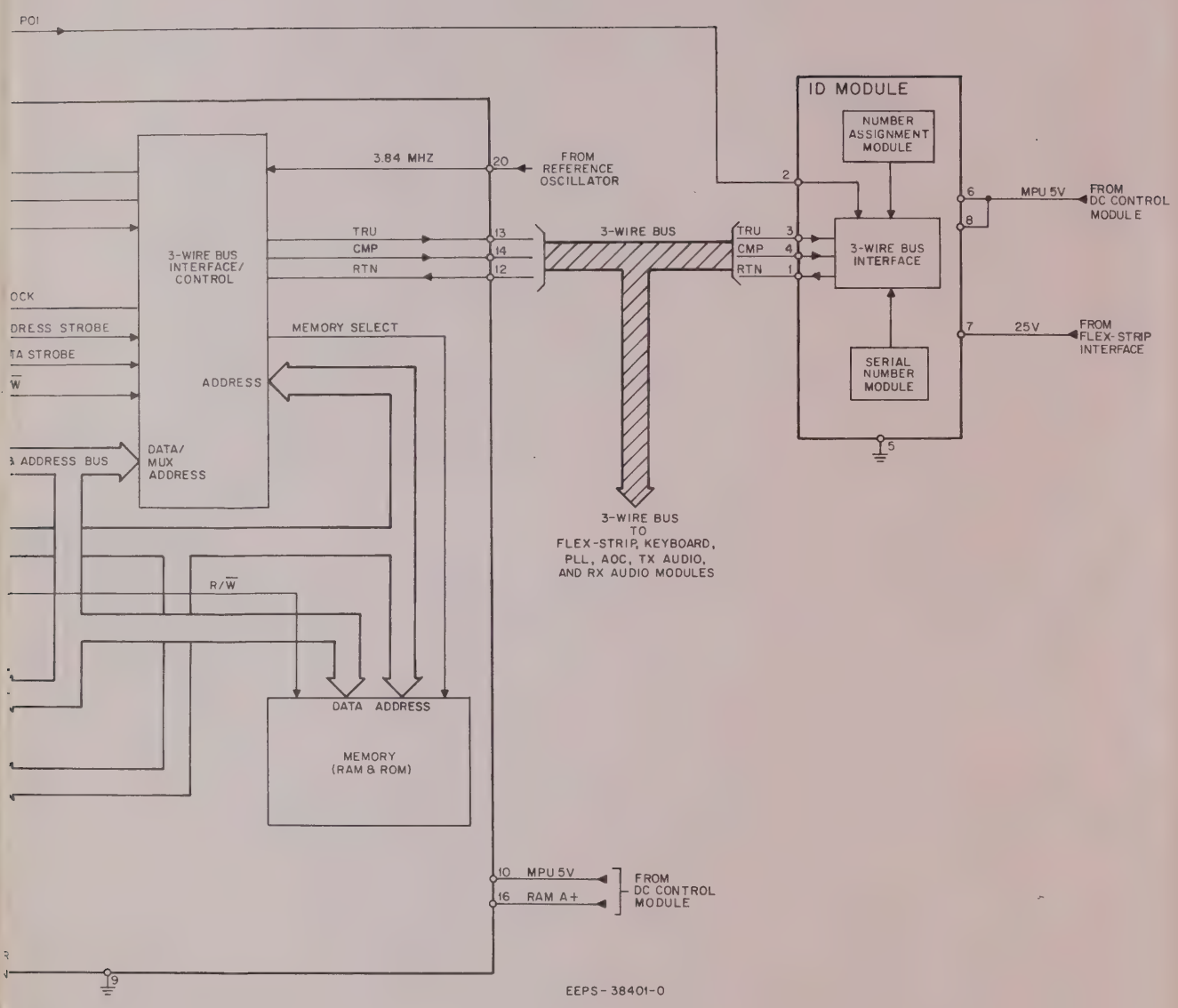
TO TRANSMIT AUDIO MODULE
FROM RECEIVE AUDIO MODULE
CEPS-38261-O


POI
ID MODULE
NUMBER ASSIGNMENT MODULE
3.84 MHZ
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FROM REFERENCE OSCILLATOR
2
6
MPU 5V
FROM DC CONTROL MODULE
8
3-WIRE BUS INTERFACE/ CONTROL
TRU
CMP
RTN
13
14
12
3-WIRE BUS
TRU 3
CMP 4
RTN 1
3-WIRE BUS INTERFACE
OCK
DRESS STROBE
TA STROBE
W
MEMORY SELECT
7
25V
FROM FLEX-STRIP INTERFACE
ADDRESS
SERIAL NUMBER MODULE
ADDRESS BUS
DATA/ MUX ADDRESS
5
3-WIRE BUS TO FLEX-STRIP, KEYBOARD, PLL, AOC, TX AUDIO, AND RX AUDIO MODULES
R/W
DATA ADDRESS
MEMORY (RAM & ROM)
10 MPU 5V
16 RAM A+
FROM DC CONTROL MODULE
9

EEPS-38401-0

TXDATA	TXDTMF	$\overline{\text{TXKEY}}$	TXSAT	VCONT	VDETECT	$\overline{\text{VOX}}$	VREF	XMT INJ	25 V	30 KHZ	3.84 MHZ	GROUND
												1,3–8, 10–16, 18–20
		6		2*	4							5
												4,10,13,16,19
									7			5
												3,9, 14
												CASE
						15					20	9
												2,3
												1,3,9,16,18
										6*	7	8,13,17
								14				2–5,7,12,13
				3	6*							CASE
	2*											4,8,13,20
												2,3,7,9,11
											5*	3,4,8
												2,3
*			11*									1,19
	2	12*	1			9*	11*					6
												2–5, 10,12,14–16,19
								15*				6,8,12
												2,3
							8			13		1,15,16
									1*			8

EEPS-38123-0

HOW TO READ THIS CHART

1. This chart shows all interconnections made by the plating on the interconnect board.

2. All pin numbers in each vertical column are electrically common.

3. To trace interconnections from any starting point to all other common points proceed as follows:

   Step 1. Find the module position or connector in the left hand column of the chart.
   Step 2. Find the desired pin number. All pins of a specific connector are listed in the line that extends to the right.
   Step 3. Note the function of the desired pin. The function is listed at the top of the column in which the pin number appears. All other pins listed in the same function column are interconnected. Those functions originating at a particular pin are identified with an asterisk (*). For each entry in the function column, trace back to the left hand column to find the module or connector number. (See Examples 1 and 2.)

EXAMPLE 1:

Logic unit module, pin 2 has a function of RADIO ENABLE (signal originates at logic unit pin 2 as indicated by the asterisk), which is interconnected to the receive audio module (pin 12), supervisory audio tone module (pin 8) and transmit audio module (pin 8).

EXAMPLE 2:

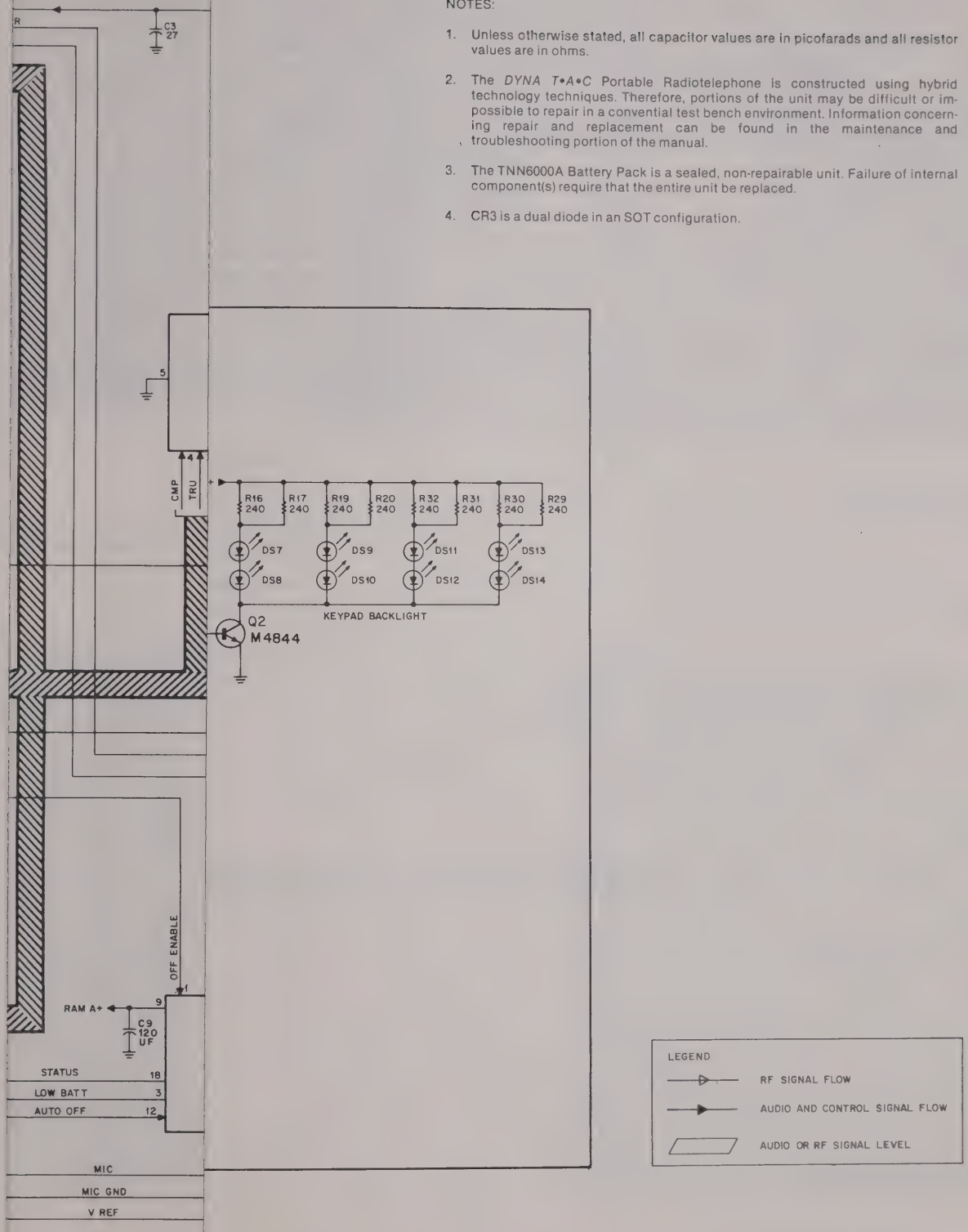
TX DATA originates at the supervisory audio tones module (pin 7) and is applied to the transmit audio module (pin 3).

NOTES:

1. The asterisk (*) indicates the point of origin of a signal or function.
2. The PWR ON/OFF signal can originate from either the keyboard or an external device connected to the options connector (J202) of the portable.
3. RAM A+ is developed on the dc control module. However, a battery on the keyboard circuit board supplies this voltage when the unit is turned off.
4. RTN is the return data path of the 3-wire bus. The Logic Unit receives the data originated by the modules connected to RTN.

NOTES:

1. Unless otherwise stated, all capacitor values are in picofarads and all resistor values are in ohms.
2. The *DYNA T•A•C* Portable Radiotelephone is constructed using hybrid technology techniques. Therefore, portions of the unit may be difficult or impossible to repair in a convential test bench environment. Information concerning repair and replacement can be found in the maintenance and troubleshooting portion of the manual.
3. The TNN6000A Battery Pack is a sealed, non-repairable unit. Failure of internal component(s) require that the entire unit be replaced.
4. CR3 is a dual diode in an SOT configuration.



Motorola No. PEPS-38640-O
(Sheet 1 of 4)
1/4/84- PHI

TXDATA	TXDTMF	$\overline{\text{TXKEY}}$	TXSAT	VCONT	VDETECT	$\overline{\text{VOX}}$	VREF	XMT INJ	25 V	30 KHZ	3.84 MHZ	GROUND
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												4,10,13,16,19
									7			5
												3,9, 14
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						15					20	9
												2,3
												1,3,9,16,18
										6*	7	8,13,17
								14				2–5,7,12,13
				3	6*							CASE
	2*											4,8,13,20
												2,3,7,9,11
											5*	3,4,8
												2,3
*			11*									1,19
	2	12*	1			9*	11*					6
												2–5, 10, 12,14–16,19
								15*				6,8,12
												2,3
							8			13		1,15,16
									1*			8

EEPS-38123–0

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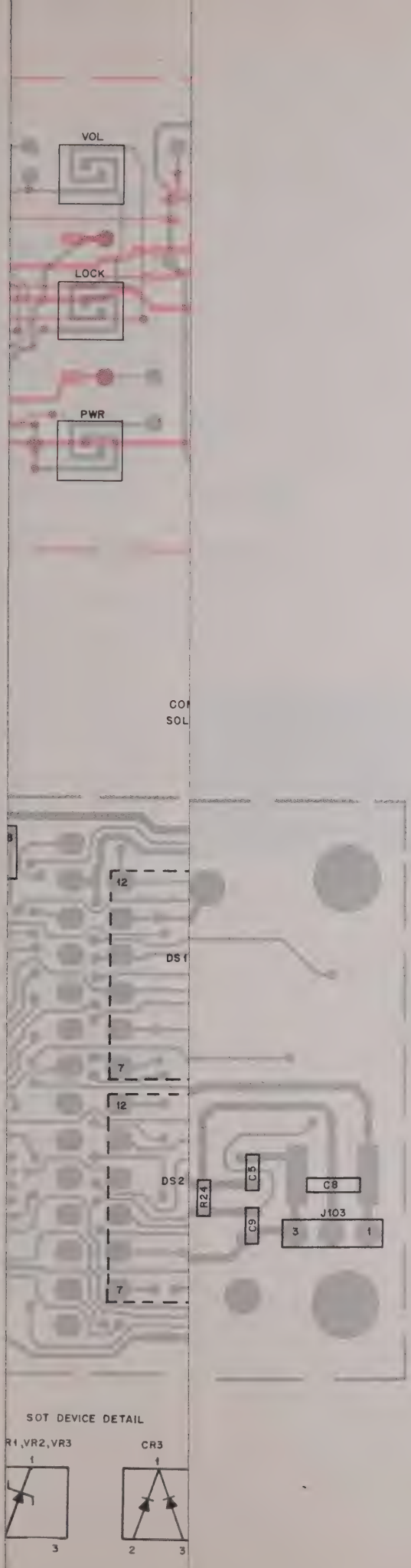
module protrusion.

lividual modules.

ification Table

Label or Stamp
TFN6048A
TLF6591A
95E26
95E10
95E11
95E12
95E13
95E15
95E16
95E18
95E17
95E23
95E20
95E22
TRN5835A
95E24
95E14
TRN5837A
95E21
95E19
KXN1119AA

connect board.



Motorola No. PEPS-38640-O
(Sheet 3 of 4)
1/4/84- PHI

module protrusion.

lividual modules.

ification Table

Label or Stamp
TFN6048A
TLF6591A
95E26
95E10
95E11
95E12
95E13
95E15
95E16
95E18
95E17
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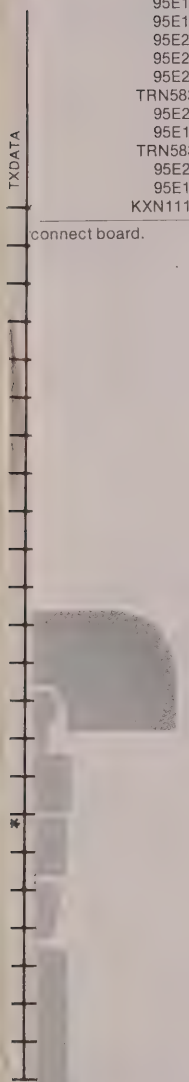
connect board.



/are PL-8879-O

A

DESCRIPTION
battery:
lithium; 3.6 V
speaker:
earpiece
transducer
microphone:
cartridge
connnector, terminals:
housing, 2-contact
housing, 2-contact
housing, 3-contact
mechanical parts
SCREW, machine: M2 × 0.4 × 5mm; 4 used
SCREW, machine: M2 × 0.4 × 4.5mm; 4 used
FRAME
HOUSING, front
GASKET, front housing
GASKET, keypad
GASKET
SCREEN, 2 used
MEMBRANE, switch
ADAPTER, alert
LIGHT, guide

TXDATA

are PL-8877-O

A

DESCRIPTION
connector, receptacle:
female
mechanical parts
NUT, machine: M2 × 0.4mm; 2 used
NUT, antenna bushing
NUT, battery contact
SCREW, machine: M2.5 × 0.45 × 6mm; 2 used
SCREW, machine: M2.5 × 0.45 × 10mm; 2 used
SCREW, machine: M2 ×0.4 × 4.5mm; 2 used
SCREW, battery latch
SCREW, battery contact; 2 used
WASHER, flat: .128 × .250 × .018"; 2 used
WASHER, spring; 6 used
WASHER, spring: plan; 4 used
WASHER, flat: antenna
INSULATOR, nylon
INSULATOR, single
HOUSING
GASKET, thermally conductive
GASKET, rubber
CONTACT, battery right hand
CONTACT, battery left hand
CONTACT, battery; 2 used
SPRING
RING; 2 used
RING, sealing
CLIP
RING, "O"
CLIP, ground
STRIP, ground
STANDOFF; 2 used
STANDOFF; 2 used
BUSHING, antenna
LATCH, battery
PLATE, latch
PAD, shock; 6 used
PAD, shock
PAD, shock
PAD, shock

PL-8878-O

A

DESCRIPTION
BOOT, port phone

e, diodes, transistors, and integrated circuits must
nbers.

MOTOROLA INC.
Communications
Sector

PORTABLE TELEPHONE SELF-TEST MODE OPERATING INSTRUCTIONS

1. INTRODUCTION

On radiotelephones equipped for self-test, the manual self-test mode may be entered, allowing the service personnel to control and monitor radio functions via the keypad. This self-test mode operates at two levels; 1) a **status display level,** which allows the portable telephone to operate as normal while providing status indications on the control unit display, and 2) the **servicing level,** which takes the portable telephone out of normal service and allows commands to be entered through the keypad to control the operation of the radiotelephone.

2. OPERATING PROCEDURES

2.1 STATUS DISPLAY LEVEL OF SELF-TEST MODE

2.1.1 This level of operation can only be entered by attaching the test interface unit to the portable telephone (in place of the battery pack) and then powering up the radio. This places the radiotelephone in the status display level of operation. In this mode, the radiotelephone will place and receive calls as normal. However, the unit will display radio status information, such as operating channel, SAT frequency, output power, etc. This display updates 20 times per second. The format and explanation of this status information is given in Table 1 under "2# Radio Status Report".

2.1.2 When dialing a phone number, the display of status information ceases with the first dialed digit. The telephone number is displayed in the normal manner as entered. When the SND button (or END or CLR) is depressed, the status information display resumes.

NOTE

Earlier versions of the portable telephone use and buttons for SND and END respectively.

2.2 SERVICING LEVEL OF SELF-TEST MODE

This level of operation allows the servicing personnel to take control of the radio operation by entering test commands through the handset keypad. Such parameters as operating channel, output power level, muting, and data transmission can all be selected by entering the corresponding commands. The servicing level may be entered from the status display level by depressing the asterisk (*) key followed by the pound (#) key. At this time, the radiotelephone will no longer function automatically in the radiotelephone system. Table 1 shows the test commands and the corresponding results.

NOTE

The radiotelephone must be in the status display self-test level in order to enable the servicing level self-test mode.

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1/4/84- PHI
68P81049E57-O

Table 1. Test Commands For Self-Test Mode

Keypad Entry	Command Description	Status Display	Result
*#	Enter Test Command Mode		
1#	Restart (Re-enter dc power start-up routine)		
2#	Radio Status Request	AAA BCDEFGH	The channel number maybe viewed by depressing the RCL key. AAA = Channel Number (decimal) B = Power Level (0, 1.....7) C = Carrier (1 = ON) D = Signaling Tone (1 = ON) E = Transmit Audio Mute (1 = muted) F = Receive Audio Mute (1 = muted) G = Mode (1 = control channel, 0 = voice channel) H = SAT Frequency 0 = 5970 Hz 1 = 6000 Hz 2 = 6030 Hz 3 = Invalid SAT
3#	Reset — Enable Watchdog Timer		
4#	Initialize Transceiver		Carrier = OFF Atten. = 0 dB Receive Audio = MUTED Transmit Audio = MUTED Signaling Tone = OFF Watchdog Timer ENABLED SAT = MUTED DTMF & Audio Tones = OFF
5#	Carrier On		Turn carrier on
6#	Carrier Off		Turn carrier off
7#	Rx Mute		Mute the receive audio
8#	Rx Unmute		Unmute the receive audio
9#	Tx Mute		Mute the transmit audio
10#	Tx Unmute		Unmute the transmit audio
11ABC#	Load Synth		Load synthesizer with ABC where ABC = channel number in decimal
12A#	Set ATTN		Set rf power attenuation to A where A = attenuation level (0, 1.....7)
13#	RESETOFF		Disable Watchdog Timer
14#	STON		Transmit signaling tone
15#	STOFF		Stop transmitting signaling tone
16#	SETUP		Transmit a five word RCC message; each of the five words will be "FF00AA55CC33".
17#	VOICE		Transmit a two word receive message; both words will be "FF00AA55CC33".
18#	SEND NAM		Displays the contents of the NAM, one data frame at a time, selected by repeatedly depressing the (#) key. **Frame** — **Contents** 1 — SIDH 2 — MIN2, MIN1 3 — SCM 4 — IPCH 5 — ACCOLC 6 — GIM 7 — Lock Combination 8 — Local Use, Preferred System, End-to-End Signaling, Repertory, Horn Alert, Hands Free, and Min Marks (left most digit is Local Use, right most digit is Min Marks)

19#	VERSION		Display software version number (4 digits)
20#	RCVS 1		Receive control channel messages counting correctable and uncorrectable errors. When the command starts, the real time count of the errors is continously displayed. The display contains two three-digit numbers; the first number is the number of correctable errors and the second is the uncorrectable errors. Entering a # key will terminate the command and display the final count.
21#	RCVV 1		Receive voice channel messages counting correctable and uncorrectable errors. When the command starts, the real time count of the errors are continously displayed. The display contains two three-digit numbers; the first is the number of correctable errors and the second is the uncorrectable errors. Entering a # key terminates the command and will display the final count.
22#	WSTS		Receive control channel messages counting word sync sequence. When the command starts, the real time count of word syncs is continuously displayed. Entering a # key will terminate the command and display the final word sync count.
23#	WSTV		Receive voice channel messages counting word sync sequences. When the command starts, the real time count of word syncs are continuously displayed. Entering a # key will terminate the command and display the final word sync count.
24#	BIBIT		Receive control channel data and display the majority voted busy/idle bit. 0 = idle 1 = busy 2 = not valid this time
25#	SATON		Enable the transmission of SAT
26#	SATOFF		Disable the transmission of SAT
27#	CDATA		Transmit continuous control channel data. All words will be the same as the "SETUP" command. When the command starts the number of the command will be displayed in the upper right hand corner of the display. Entering a # key will terminate the command. **NOTE:** For the WSTS, WSTV, RCVS1, RCVV1, and CDATA commands, once the command is started, no key will be recognized except the # key.
28#	HITNON		Activate the high tone (1150 Hz).
29#	HITNOFF		De-activate the high tone.
30#	LOTNON		Activate the low tone (770 Hz).
31#	LOTNOFF		De-activate the low tone.
32#	INVM		Initialize non-volatile memory to all zeros.
33A#	DTMFON		Activate DTMF tone (A = DTMF digit).
34#	DTMFOFF		De-activate DTMF tone.
35#	RSSI		Display RSSI value of present channel.
36#	SCAN FAST	AAABBB	Tune successively from channel 1 to 666 displaying each channel number and RSSI reading for that channel, where AAA = Channel Number, BBB = RSSI Reading. Entering (*) pauses the scan and displays the current status of the unit. Entering (*) again causes the scan to continue. Entering (#) aborts the scan and leaves the portable tuned to the current channel. This scan takes approximately 25 seconds. During this command, only the (#) and (*) keys will be recognized.
37#	SCAN SLOW	AAA BBB	Tune successively from channel 1 to 666, displaying each channel number and the RSSI reading for that channel, where AAA = Channel Number, BBB = RSSI Reading. Entering (*) pauses the scan and displays the current status of the unit. Entering (*) again causes the scan to continue. Entering (#) aborts the scan and leaves the mobile tuned to the current channel. This scan takes approximately six minutes. During this command, only the (#) and (*) keys are recognized.
38#	COMPD-OFF		Disable the compressor annd expandor.
39#	COMPD-ON		Enable the compressor and expandor.

MOTOROLA

USER QUESTIONNAIRE

To the User of This Instruction Manual:

Motorola is engaged in a continuous program of improving its instruction literature. We believe that you can aid us in this program, so that we in turn can better help you service our equipment. To foster these aims, would you please answer the following questions:

SCHEMATIC DIAGRAMS AND CABLING DIAGRAMS

1. ☐ Are accurate and easy to follow
2. ☐ Contain minor errors
3. ☐ Contain major errors
4. ☐ Are difficult to follow

If you have checked any box except 1, please tell us what schematic diagrams, or portions thereof, were at fault, or enter other comments.*

_____

_____

TEXT

1. ☐ Easy to follow — helps to service equipment
2. ☐ Would like more information on*

_____

_____

3. ☐ Some instruction sections are too long or superfluous such as*

_____

_____

4. ☐ Other comments*

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3. ☐ Some are superfluous such as*

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AVAILABLE BACKGROUND REFERENCE PUBLICATIONS

Five reference publications are available to provide background information needed to service some of the newer Motorola products more effectively. The information in these publications is not duplicated in our instruction manuals. To obtain your free copy, check the ones you want and return this self-mailer to us. (NOTE: One copy of each publication has already been distributed to Motorola Service Shops (MSS's) and field technical representatives (FTR's).

Check item desired:

☐ **Basic Logic Circuit Guide** — 68P81105E88
Describes the basic logic circuits used in Motorola Communications digital equipment and the logic notational scheme used in our instruction manuals.

☐ **"Digital Private-Line" Binary-Coded Squelch** — 68P81106E83
Contains fundamentals of "Digital Private-Line" system operation, circuit operation and servicing techniques.

☐ **Safe Handling of CMOS Integrated Circuit Devices** — 68P81106E84
Describes special handling techniques needed to prevent irrepairable damage from static charges encountered with normal handling of CMOS devices.

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Defines the major sources of noise encountered in a mobile radio installation and suggests methods of remedying them.

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